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A PRIZE OF ONE HUNDRED DOLLARS.

The ELECTRICAL REVIEW desires to publish an article upon the electric lighting central station superintendent—his duties, how he may best fit himself for them, what steps he must take to insure success in that profession, and what type of man is best fitted by character, experience, education and brain texture for employment under conditions of great responsibility by owners of such installations. We offer a prize of $100 for the best article of not less than three thousand nor more than five thousand words in length, received before May 1, 1901. Only articles written by members or associate members of the American Institute of Electrical Engineers, or members of the National Electric Light Association will be considered.

THE GENERAL ELECTRIC COMPANY'S SCHENECTADY WORKS.

On other pages of this number an article describing in a general way the superb equipment of the General Electric Company at its Schenectady shops is begun. While it is beyond the province of a single article to treat such an establishment in detail, it has been attempted in this paper to give a general view of the establishment and of its method of operation.

This company itself and its works are essentially representative of American products as applied to the manufacture of commodities in general, especially to those in whose making the engineering arts enter. Formed itself by numerous coalitions of smaller corporations, and practically co-extensive with the industry of applied electricity in the scope of its operations, the company's method of work is an excellent object lesson of what is best in American works-management and methods of production.

The crude materials of such an establishment may be regarded as threefold—labor, brains and ordinary material. By the combination of these three elements the finished result is produced and the effort of a manufacturing establishment should be directed to produce, by the greatest exercise of brains, the best results from the least amounts of labor and material. Perhaps nowhere is the direct result of careful study and design as applied to labor-saving machinery—that is, the effect of brains in industry—better shown than at the works referred to.

Second perhaps in importance to the wide use of labor-saving and automatic machinery is the elaborate standardization of parts and product which this company has carried out in great detail. Standardization means ease of production of a large number of similar parts or machines, and, when applied to the machine tools and appliances making the product, it means uniformity which will insure successful operation of parts put together at great distances from the place of manufacture. By standardization also there have been produced forms of apparatus which experience has shown to be of great excellence for each particular purpose, and the facility with which these may be produced and the low cost at which they may be sold in comparison to machines designed especially for specific purposes, have practically compelled the use of standard apparatus in electrical installations in this country.

The result of these factors has been a more widespread extension of the use of electricity in the common service of the people here than anywhere else in the world. It seems reasonable to believe that the tremendous advance that has been made in the United States in the electrical arts has been largely due to the standardization of apparatus and parts leading to their cheapening and to quickness in production and delivery, and consequent extension of use.

Without instituting a comparison between the work of the General Electric Company and that of other manufacturing concerns in the United States, it is certain that this work is representative of the best modern ideas in American products and may readily stand as a type of the best that we have shown in the line of electrical manufacture.

ELECTRICAL EXECUTION.

We have lately received from Dr. Carlos F. MacDonald, of New York, a pamphlet dated 1893, entitled "The Infliction of the Death Penalty by Means of Electricity," which is evidently a reprint from a state publication.

In this Dr. MacDonald makes an able plea for electrical execution, and gives at length and with much detail reports of the first seven executions under the New York state laws and of the results of

the autopsies held afterward. We assume that this pamphlet was sent to us as a rebuttal of the position we have taken concerning the barbarity of this variety of execution; but it is good to be able to have so eminent an authority as Dr. MacDonald on our side, because on page 310 of his pamphlet he says: "The passage of an electrical current of the pressure employed in these cases (of approximately from 1,400 to 1,700 volts) and in this manner does not do any damage to any of the internal organs, tissues, or muscles. None of these parts are lacerated or changed in volume; neither are there any gross chemical or morphological changes or alteration of their finer structural features."

The whole question, as to whether electrical execution is humane or otherwise, must rest in *statu quo* until an experiment is made to resuscitate one of the victims after he has received the, apparently, deadly shock. The evidence adduced by Dr. MacDonald does not prove to the layman, at least, that criminals executed in this way are killed by electricity. It is, of course, evident that they are thoroughly dead after the autopsy, but it is still uncertain whether they are dead before it, and the doctor's own words quoted above seem to suggest that it might be possible to resuscitate a man whose condition is no worse than he has stated.

It is not intended here to undertake any crusade against capital punishment. There are many known methods by which sudden and painless death may be inflicted, and it seems more in harmony with the civilization of this century to employ one of these than the method now in vogue in New York and several other states. If the electric current instantly and painlessly killed the man subjected to it there could be no reasonable objection to this variety of execution. But when it is believed, by those sufficiently versed in the matter to make their opinions valuable, that the victim is only stunned by the current, and subsequently killed by the autopsy, it seems as if there certainly should be a thorough, competent, and official investigation of the question. Men have been apparently killed in electrical stations, and have completely recovered after treatment by the simple methods of stimulation and artificial respiration.

It is curious to note that the elaborate and evidently official report of the executions referred to above contains nowhere any statement of the frequency of the alternating current employed, though this is now known to be one of the most important factors which enter into consideration in such cases.

WIRELESS TELEGRAPHY.

The improvement of wireless telegraphy methods since Mr. Marconi's announcement of his somewhat spectacular invention has been remarkable. It has lately been announced that messages have been successfully transmitted for about two hundred miles along the British coast without relaying, and it is thought that this achievement will soon be surpassed. Lately also there has been announced by Dr. Slaby a method for selective telegraphy whereby several stations can operate simultaneously in the same field without interfering with one another. Experiments are under way by most of the more important governments for the use of this system of telegraphy in war and for the protection of shipping. A few installations have been made for regular practical work, but these are of relatively minor importance. Several steamship lines are at present experimenting with wireless telegraphy as a means for announcing the approach of ships and of communicating between them and the shore.

This is the present state of the art, and its growth has been so rapid and its progress so certain that we are forced to the belief that great advance will be made in the near future. At the same time it must be confessed that there is little indication of wireless telegraphy finding a wide range of application. The difficulty with the system is inherent in the very nature of it. It will be practically out of the question to work any considerable number of systems in the same area. Even if tuning is made very perfect the possible number of tuned sets of such apparatus is comparatively limited. It is probable, from all the considerations that bear upon the subject, that much the largest use of this process of communication will be for maritime purposes of one sort or another. The equipment of a majority of vessels with some such system would certainly be of immense value and importance to commerce and as a means of preventing accident and saving life. With signaling apparatus of the simplest type and an international code of signals based upon numbers of taps, communication could be held from a vessel with any other within the sphere of its influence whether the vessels were visible to one another or not. It is believed by many who have entered at length into this subject that here will be the most promising field for the development of wireless telegraphy, and that in this field will be its greatest achievement and usefulness.

THE NATIONAL STANDARDIZING BUREAU.

Among the last acts of the Congress which has just adjourned was the passage of the bill to establish the National Bureau of Standards. The bill appropriated $100,000 toward providing a suitable building, the entire cost of which must not exceed $250,000. It is to be erected in the District of Columbia, probably in some suburban neighborhood where it will be possible to escape earth tremors and the influence of heavy electric currents in the vicinity, and its construction is to be begun at once. No wiser action was ever taken by Congress in a matter of importance to the commerce of the country. No one can doubt that the effect of the bureau will be directly and immediately beneficial in all the engineering industries. We have in these columns often argued for the erection of such an institution and it is pleasant to know that at last the government has taken the action which has been so strongly desired by scientific societies, engineering corporations, and individuals familiar with the situation. It is to be hoped that within a few years the institution will enjoy the same reputation that is now possessed by the German Reichsanstalt. It can not fail to exert an immediate and directly beneficial influence on American electrical manufactures.

THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—XIX.

BY W. ELWELL GOLDSBOROUGH.

On page 184 it is demonstrated that under certain circumstances the capacity of a series circuit containing resistance, inductance and capacity may be so adjusted as to entirely neutralize the effect of the inductive reactance of the circuit, and cause the current to attain a value equal to that which would result if reactance were entirely removed from the circuit.

The inductance in a circuit can also be neutralized by placing a condenser of suitable capacity in *parallel* with the inductance. The effect of this adjustment is very different from the series arrangement. In the latter there is danger of producing a local and abnormal rise in voltage, whereas by the method of paralleling the inductance there is danger of causing an abnormal current to flow locally between the condenser and the induction coil.

In explanation of this effect we will consider such a circuit as that shown in Fig. 52. Here the electro-motive force E is impressed upon the system OA, which consists of the inductive circuit O_1A_1 connected in parallel with circuit O_2A_2 containing the condenser C_2. In Fig. 52 we have the vector diagram showing the relative magnitude of the forces acting. The vector OA represents the impressed electro-motive force, and since r_1, L_1 and ω are known, by applying equations (54) and (55) the value and phase position of the vector OB_1, equal in length to the current I_1, are readily determined. The current set up in the second circuit O_2A_2, since it contains only the condenser C_2, will, by equation (136), be 90° in advance of the impressed electro-motive force and be equal in value to $EC\omega$ by (143). In the vector diagram it appears as the vector OB_2 drawn 90° in advance of OA.

Now since OB_1 and OB_2 represent currents flowing in parallel circuits, their vector sum will equal the current in the main circuit OA. Therefore, completing the parallelogram OB_1 BB_2 O, we have the diagonal OB as the vector equivalent of the current in the supply mains.

In this case it is shown that OB coincides with OA, therefore the current in the supply mains is in phase with the impressed electro-motive force, and the equivalent reactance of the system is zero.

The equivalent resistance of the system is not, however, equal to the non-inductive resistance r_1. If it was the resultant current vector OB would have to be several times longer than it is to proportionally represent the current in the supply mains.

As a matter of fact, since I_2 is a wattless current and I is in phase with E, I_1 is equal to the vector difference of I and I_3. Therefore, I_2 must be equal and opposite to the wattless component of I_1, and I must be equal to the useful component of I_1. But the useful component of the current in the first branch circuit is equal to the product of the impressed electro-motive force and the conductance of the first branch circuit, therefore

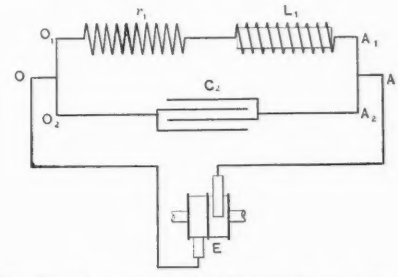


FIG. 51.—ALTERNATING-CURRENT MECHANISMS.

$$E\, g_1 = I = E\, \frac{r_1}{r_1^2 + x_1^2}$$

from which the equivalent resistance of the system is equal to

$$r = \frac{E}{I} = \frac{r_1^2 + x_1^2}{r_1} \qquad (179)$$

The equivalent reactance of the system is equal to zero, since I is in phase with E, and since, as shown above, the wattless component of I_1 is equal to I_2. Therefore

$$E\, b_1 = E\, b_2 \text{ and } b_1 = b_2$$

or by substitution in accordance with (166)

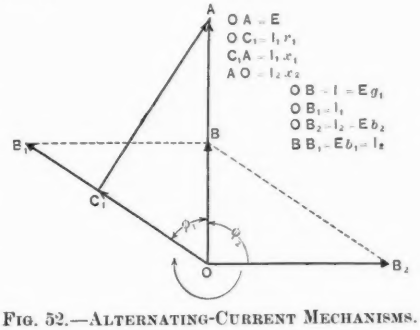


FIG. 52.—ALTERNATING-CURRENT MECHANISMS.

$$\frac{x_1}{r_1^2 + x_1^2} = \frac{1}{x_2}$$

since the resistance of the second parallel circuit is zero.

Finally, then, we find that the capacity, which when shunted around an inductive circuit will neutralize its reactance, is equal to

$$C_2 = \frac{L_1}{r_1^2 + x_1^2}$$

Fig. 52 illustrates the fact that it is possible to effect an adjustment the result of which will be to cause currents to flow in certain portions of a circuit that are in excess of the main current. This difference can be made experimentally to reach any magnitude that is desired. It is possible to cause a hundred amperes to be locally exchanged between properly tuned coils and condensers while the supply current may not exceed one ampere. Or the difference may be made many times greater than this.

It is not often that local current rushes are met with commercially, and when they do occur they are more apt to be due to pulsating reactions between dynamo machines connected in the circuit than to the balancing of inductance by capacity. However, in the case of long-distance transmission lines, over which energy is transmitted at very high potentials, effects closely analogous to these are always noticeable; although the charging currents, as the excess currents are called, extend throughout the system over miles and miles of wire, and are not confined to any specific locality.

As indicated by the phase position of the vector OB_2, Fig. 52, the charging currents are essentially wattless currents, and are not productive of useful work.

Example No. 9.

Given: A circuit consisting of an induction coil that is energized by an alternator which develops an electro-motive force of 60 volts at a frequency of 60 cycles per second. The resistance of the coil is .61 of an ohm and it has an inductance of .00246 of a henry.

What is the value of the current flowing in the circuit? What would have to be the capacity of a condenser large enough to bring the current in the armature of the alternator into phase with the electro-motive force at the brushes of the alternator? To what extent would the introduction of this capacity reduce the current below its initial value? What would be the equivalent resistance of the system after the induction coil was shunted by the condenser?

Applying equation (54) the initial value of the current flowing through the induction coil is found to be

$$I_1 = \frac{60}{\sqrt{.61^2 + .93^2}} = 54 \text{ amperes,}$$

since the reactance of the circuit equals $.00246 \times 2 \times \pi \times 60 = .93$.

The condenser capacity needed to bring the armature current into phase with the impressed electro-motive force is determined by applying equation (180). Therefore

$$C_2 = \frac{.00246}{.61^2 + .93^2} = .002 \text{ of a farad}$$

$$= 2{,}000 \text{ micro-farads.}$$

This is a capacity much too great to be conveniently supplied with any form of commercial condenser. The introduction of such a capacity, however, would re-

duce the value of the armature current to equality with the useful component of the initial current, and, therefore, it would be equal to

$$E\, g_1 = E \frac{r_1}{r_1^2 + x_1^2} =$$

$$60 \frac{.61}{.61^2 + .93^2} = 30 \text{ amperes.}$$

The presence of the condenser, then, would so modify the conditions that a current of 54 amperes would continue to flow through the induction coil while only 30 amperes would be supplied to the circuit by the alternator. The current flowing in the condenser at this time would be equal to

$$EC\,\omega = 60 \times .002 \times 377 = 45 \text{ amperes.}$$

The equivalent resistance of the system after the introduction of the condenser is

$$r = \frac{E}{I} = 2 \text{ ohms,}$$

an increase of 300 per cent over the initial resistance of the system.

The vector diagram, Fig. 52, shows the relative magnitude of the factors involved in this problem. Should the value of r_1 be reduced, and the value of C_2 be increased, the vector OB would correspondingly shorten, and the vectors OB_1 and OB_2 lengthen, if the figure was modified to meet the changing conditions.

VARIABLE LINE FACTORS.

Up to the present time we have only considered problems in which the line factors involved are constant quantities. It often happens, however, in alternating-current working, that one or more of these factors sustains marked fluctuations in value and it is important that the effects due to such changes should be well understood.

A simple series circuit presents a very fruitful field for these investigations, and we can not do better than turn first to a series circuit containing resistance and inductance, such as that diagrammatically shown in Fig. 19, page 569, vol. xxxvii. In such a circuit the equation of condition is

$$I = \frac{E}{\sqrt{r^2 + x^2}} \qquad (54)$$

where (x) represents an inductive reactance. Now if E and (x) are maintained, at constant values and (r) is gradually varied in value from *infinity* to *zero*, what will be the effect upon the value of the current?

Since

$$E^2 = (I\,r)^2 + (I\,x)^2 \qquad (181)$$

and E is a constant, the electro-motive-force vector triangle will always be a right-angled triangle, described on E as an hypotenuse, whether the value given to (r), and so, as shown in Fig. 53, the heel C of the triangle OAC, in which OA = E, OC = I r and CA = I x, will always fall on the semi-circle ACO, described on OA as a diameter. This semi-circle is then the locus of the point C, which will move from A toward O as (r) decreases in value, since when (r) is very large I r will approximate in its phase position and value the vector OA, while when (r) is very small I x will be very great relatively to I r and so approximate in phase and value the vector AO, which is the equal and opposite of OA.

Now, since the current is always in phase with the resistance electro-motive OC, and since as (r) decreases OC moves from

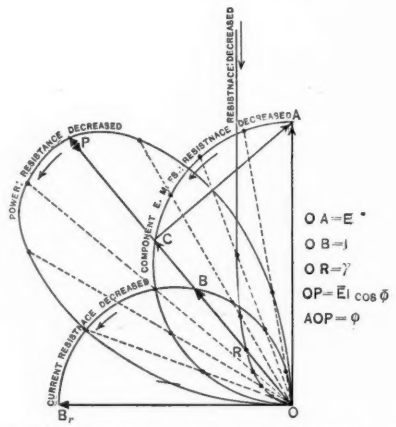


FIG. 53.—ALTERNATING-CURRENT MECHANISMS.

a position in which it coincides with OA to one in which it is tangent to the semi-circle ACO at O, the phase position of the current changes from an angular lag of zero degrees to an angular lag of 90°. Moreover, during this change in phase position, as (r) decreases I undergoes a change in value that is proportional to the reactance electro-motive force I x, since (x) is a constant. Again, the current vector OB is always at right angles to the reactance electro-motive-force vector CA; since, then, the locus of the point C is a semi-circle, the locus of the point B will also be a semi-circle, but one described on a diameter at right angles to AO, the value of I x when $r = o$. The current reaches its maximum value, then, when $r = o$, and from (54) equals

$$I_{max.} = \frac{E}{x} = OB_r$$

From Fig. 53 we see that as the resistance decreases in a circuit containing resistance and inductance the working component OC of the impressed electro-motive force also decreases, but that the current increases. To determine the effect this decrease in the resistance has upon the amount of power absorbed in overcoming the resistance of the circuit the product of the vectors O B and OC, corresponding to successive values of (r), is taken. These products are equal to the energy apparent in the circuit, and when plotted as vector quantities in phase with the corresponding current values give the energy locus of the circuit. For the position OB of the current vector, OP is the power vector.

The value of (r) for which the energy dissipated in the circuit is a maximum is determined by taking the first differential of the power equation with respect to (r) and equating it to zero.

By equations (92) and (54)

$$P = \bar{I}^2 r = \frac{\bar{E}^2 r}{r^2 + x^2} \qquad (182)$$

therefore

$$\frac{d\,P}{d\,r} = \bar{E}^2 \frac{x^2 - r^2}{r^2 + x^2} = 0 \qquad (183)$$

from which

$$r = x.$$

But when $r = x$, by (55), the tangent of the angle of lag of the current behind the impressed electro-motive force is equal to unity, or the *angle of lag of the current is 45° when the dissipation of energy in the circuit is a maximum.*

Furthermore, the power locus loop is symmetrical about the line that bisects the angle AOB_r, *i. e.*, about the vector of maximum power.

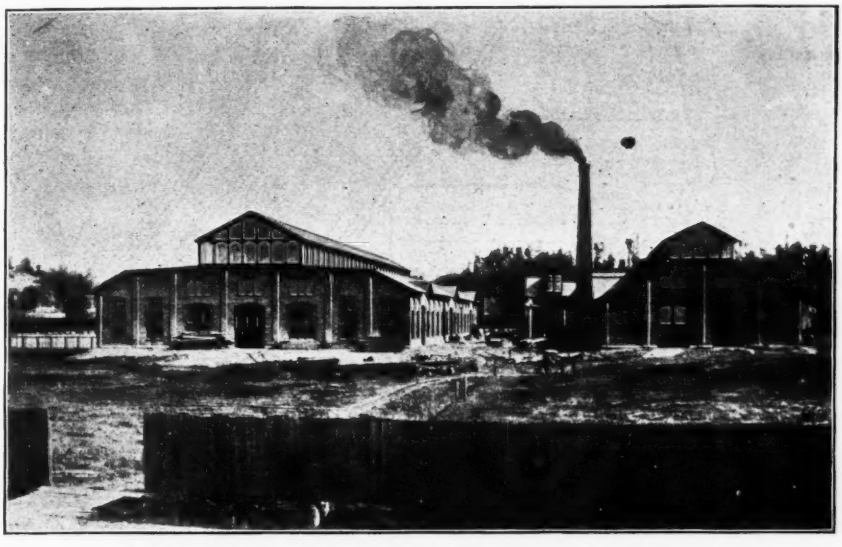
(It must not be inferred from the foregoing discussion that the power vector OP has the same frequency of rotation as the current and electro-motive-force vectors. The curves of Fig. 25, page 657, vol. xxxvii, illustrate the fact that the power curve which results from the product of the instantaneous values of an electro-motive force and current, that are in phase with one another, is always a maximum when the current is a maximum, and that the power vector and the current vector are either in phase or displaced from one another by an angle of 180° whenever the current attains its maximum. It is only in this limited sense that the power vector can be considered in the same diagram with the current and electro-motive-force vectors, since the frequency of the former is twice that of the latter. It is further to be noted that the length of the power vector, see Fig. 25, is equal to the *average* value of the ordinates of the power curve, while the current and electro-motive force vectors are usually made equal to either their maximum or their virtual values.)

The city council of Richmond, Ind., recently let a contract for a municipal electric light plant to an Indianapolis construction company for $144,490.

The Schenectady Works of the General Electric Company—I.

The Largest and Most Complete Electrical Manufacturing Establishment in the World—Some Account of Men, Methods and Machines—A Representative American Industry.

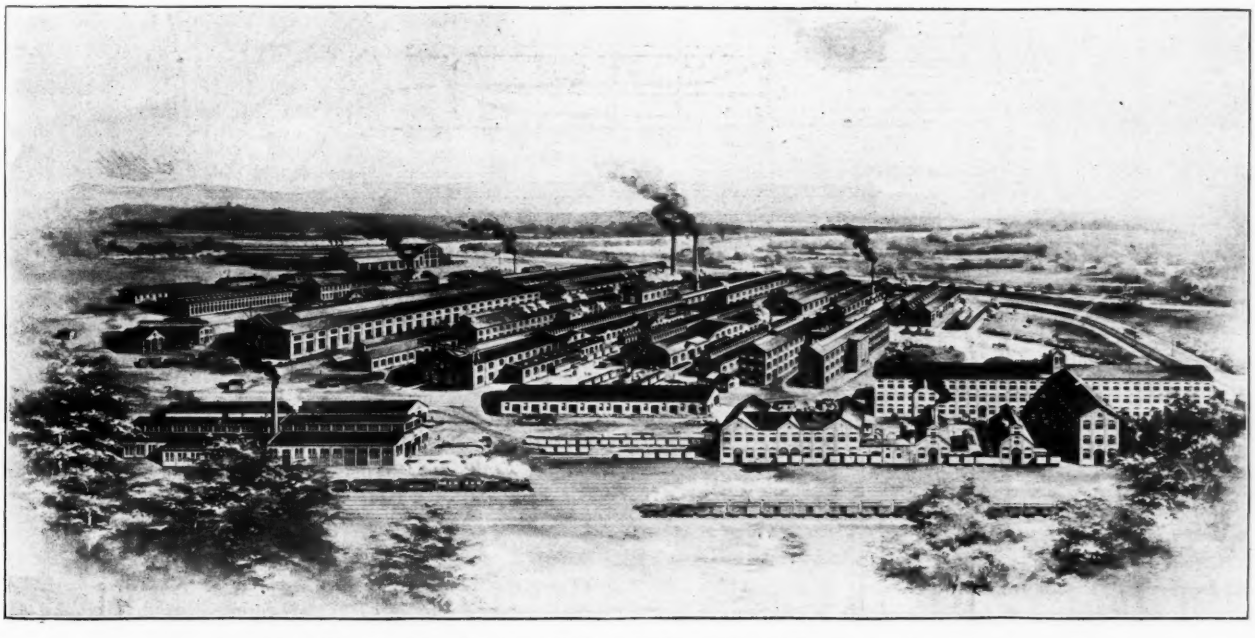
The city of Schenectady is one of the oldest in the United States and to-day in many ways it shows evidence of its origin as a Dutch village, founded by the hardy pioneers of that nation who made their way westward over the divide from Fort Orange, now called Albany, and settled in a curve of the Mohawk River. Here they founded the village of Old Dorp, the name having been changed in the later years of English occupancy to Schenectady, a word borrowed from the Indian languages then still obtaining in the vicinity.



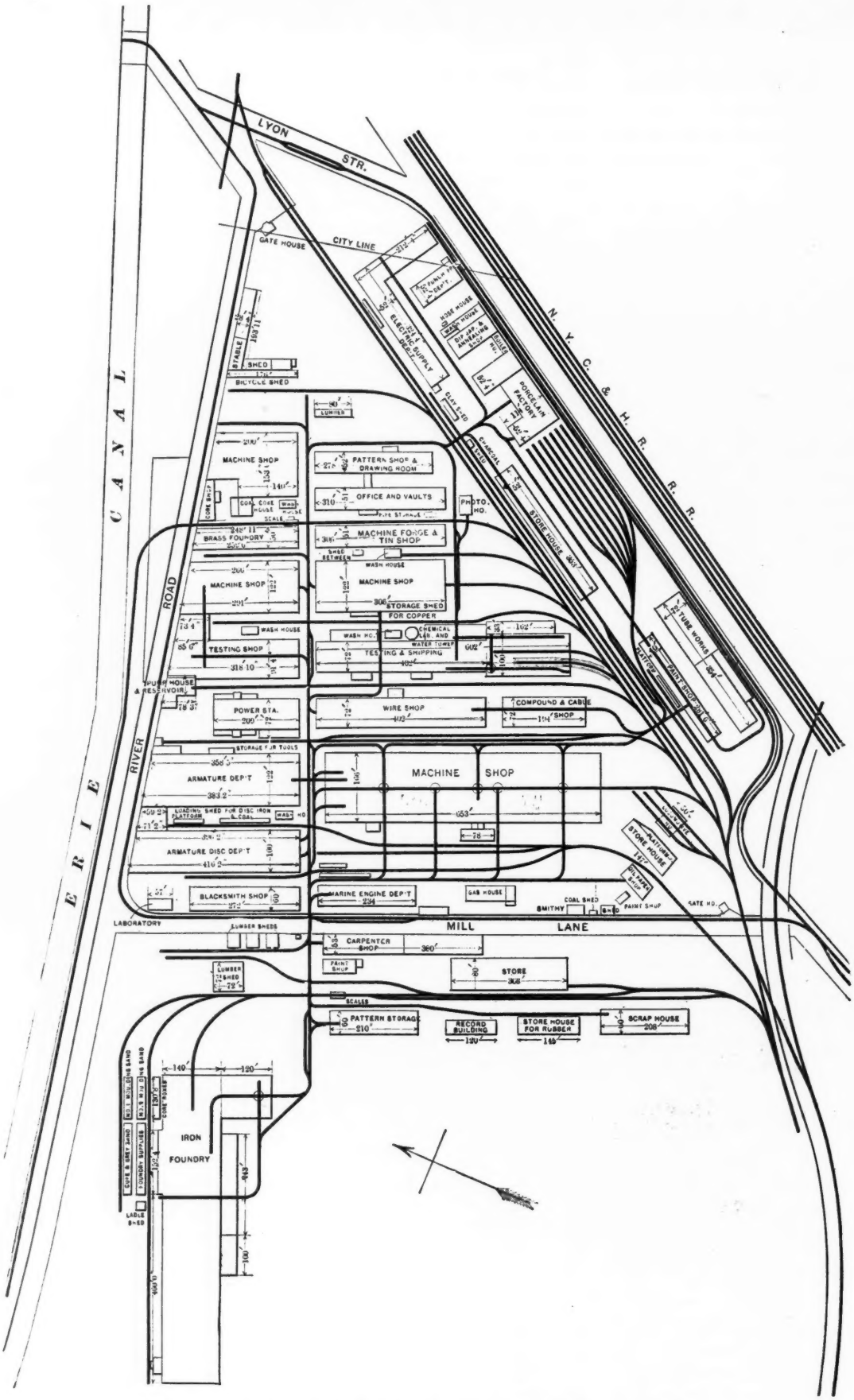
The General Electric Company's Schenectady Works in 1888.

Up to 1886 the little town grew slowly and prospered, presenting in that year an excellent example of the well-to-do, well-kept town of our interior country and known widely both for the location of Union College and for the great locomotive works which were in operation there. It was in the year 1886 that the Edison General Electric Company, then seeking to consolidate its various manufacturing interests which were scattered in a number of places in the vicinity of New York city and in the city proper, bought the buildings and lands of an unused factory site and established itself in Schenectady to begin there an industry which has later grown to be the greatest of its kind in the world.

It is useless in an article of this kind to attempt the description in detail of the manifold industries and processes of manufacture that are gathered together in the works of the General Electric Company for the reason that they embrace practically every art known in electrical manufacturing and in the manufacture of mechanical appliances necessary to the electrical engineer, with the single exception of wire drawing. Indeed, any attempt at a detailed description would result in a catalogue of industries too great in volume to be of interest, and it will, therefore, be the attempt of this paper to present rather a general view of the



The General Electric Company's Schenectady Works in 1901.



SKETCH PLAN OF THE GENERAL ELECTRIC COMPANY'S SCHENECTADY WORKS.
Scale 300 feet to 1 inch.

work carried on in the Schenectady plant than to enter into any details of its minutiæ.

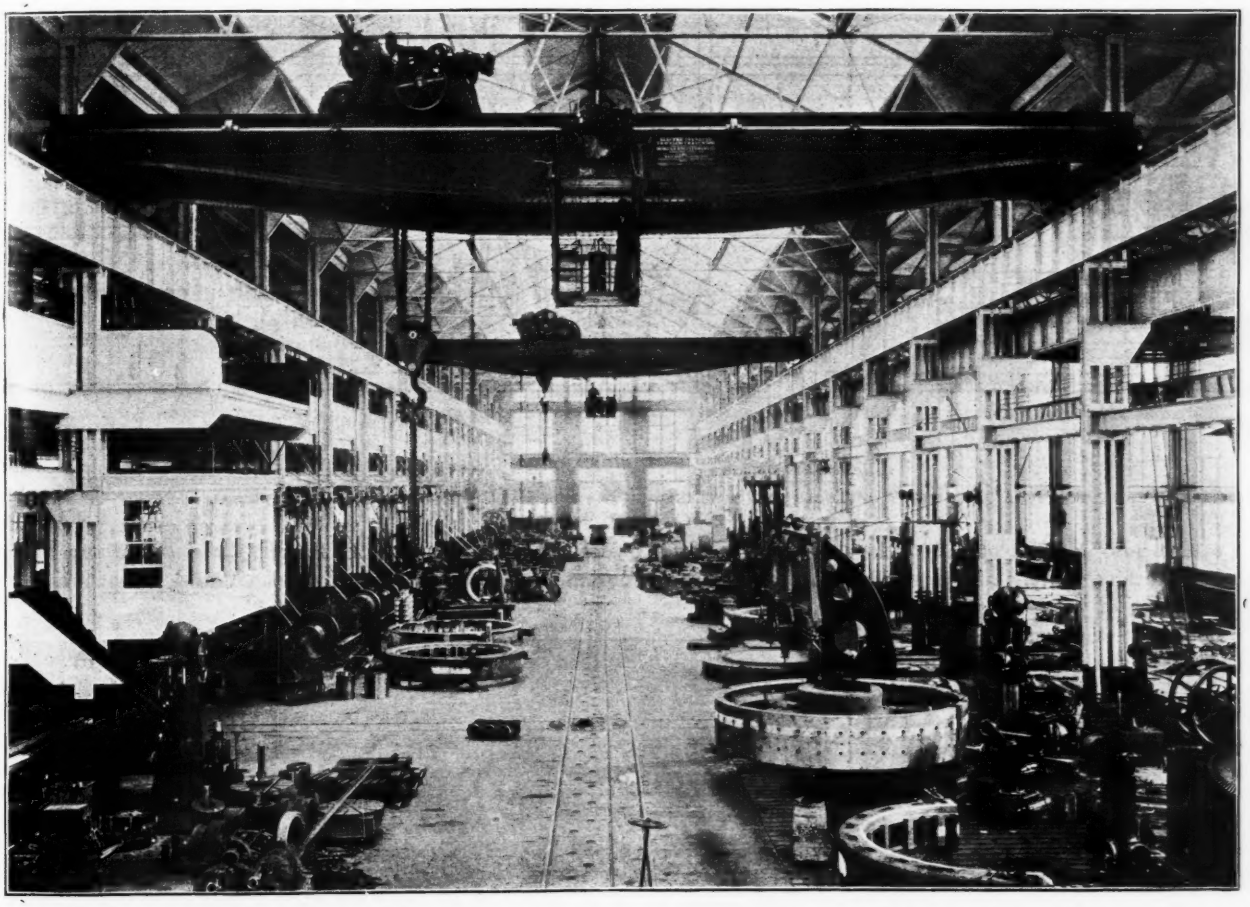
Perhaps nothing can give a better idea of the extent of the operations of this company in these works than the sketch map of the grounds and buildings occupied and the view of the workmen coming out of the factory at evening, to be found in these pages. Here, in an enclosure of 150 acres, and working in the 1,350,000 square feet of floor space of the 114 buildings which occupy that space, are daily gathered an army of nearly 7,500 men and women engaged in the various operations involved in duties ranging from those of managing directors of departments to those of laborers who keep the grounds and buildings clean.

In brief, the work of the company consists in the manufacture of electrical apparatus of all known varieties except instruments of precision and research, telegraph and telephone apparatus and deep-sea cable apparatus. Of course, much of the largest part of the work is in the manufacture of dynamo machines and electric motors of the various kinds and types employed in the arts as well as in such accessory apparatus as these demand for their control, regulation and use, the making of all parts of electric railway systems except rails, cross-ties and poles, and the fabrication of steam engines of a particular type intended to be used in connection with electric generators for isolated plants and particularly for the lighting of ships.

All of the materials received at the works for subsequent manipulation are in their crude state with the single exception of copper wire and bars such as are used in making commutators. Indeed, these may be classed also as crude materials of construction, since the wire and the bars pass through many processes before they are fitted to take their place in the finished machinery which is the product of the company. Beginning, then, with the reception of coke and pig iron on the sidings adjoining the foundry building it is profitable to look in some detail at the various processes involved in the manufacture of large modern electrical machinery as carried on at these works.

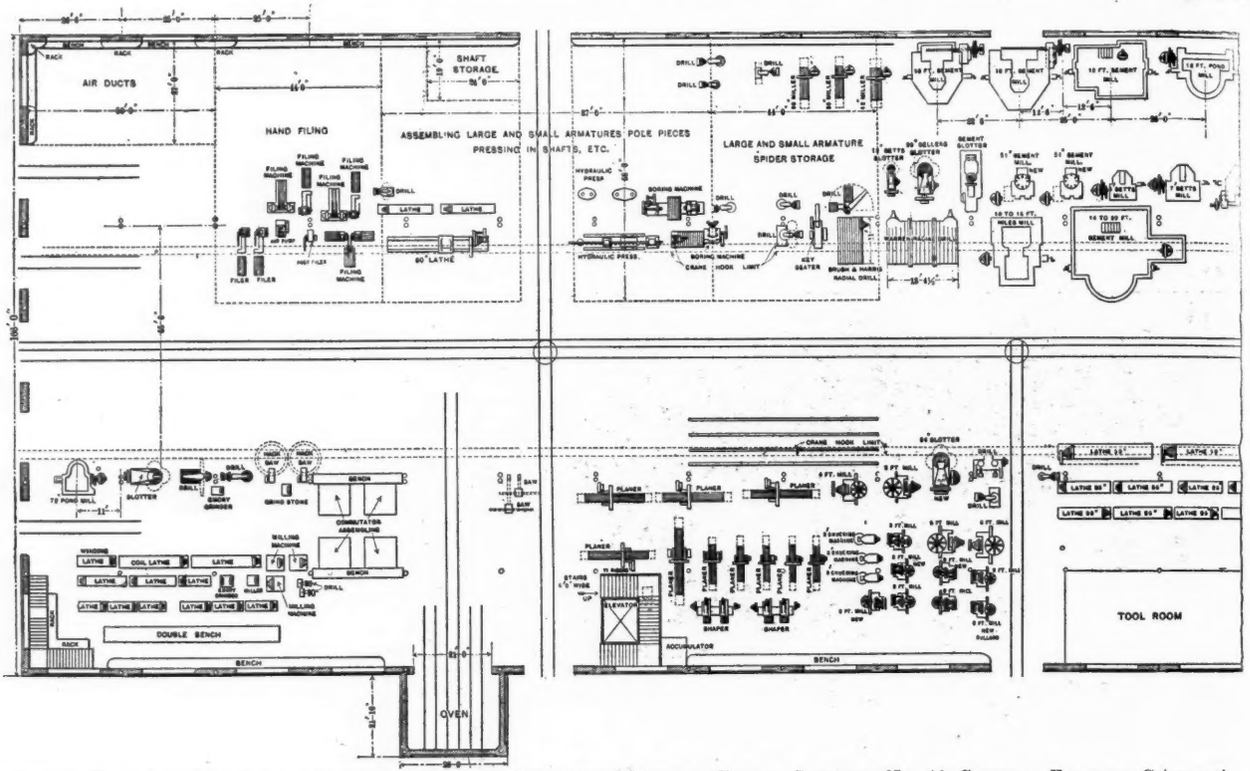
The iron foundry building is the largest single building devoted to iron founding in the world. The ground plan of the building is a rectangle 743 by 140 feet and this space is given over entirely to castings in iron. Of this metal a number of particular varieties are employed, these having been selected after long experiment as best available for the manufacture of electrical machinery. It will interest the average foundry man to know that a very large proportion of the work done in this foundry is cast from struck moulds. Much the largest proportion of pieces entering the construction of electrical machinery are circular or cylindrical in shape, or are symmetrical repetitions of a single design. This condition adds much to the ease with which struck work may be done and the number of castings requiring complete patterns is comparatively small. It may also add somewhat to an easy comprehension of the volume of work now being done in this foundry to know that 40 barrels of flour are consumed each week in the manufacture of cores.

In both the iron foundry and the brass foundry a considerable number of moulding machines have been installed, these being used for the making of moulds for small parts which are reproduced in great number. Some very complicated castings



One End of General Electric Company's Large Machine Shop, Showing Traveling Cranes.

are made in moulds formed by these machines, among them the cast-iron grid used in the resistance boxes of street railway equipments. In its operation the moulding machine entirely dispenses with hand ramming of the sand, all ramming and shaping being done by pneumatic pressure controlled by the operator. A very great speed in the preparation of moulds is thus attained, a single operative with a machine being able to put up a flask of about one cubic foot capacity in two minutes.



GROUND PLAN SHOWING ARRANGEMENT OF TOOLS AND MACHINES IN EASTERN END OF BUILDING NO. 16, GENERAL ELECTRIC COMPANY'S SCHENECTADY WORKS.

The factory buildings are grouped, for the most part, with their ends facing the two sides of a street. The accompanying plan of the works gives an excellent idea of the arrangement of buildings and railway tracks. One of these shops, building No. 16, is the largest building on the company's grounds and one of the largest used for similar purposes anywhere in the world.

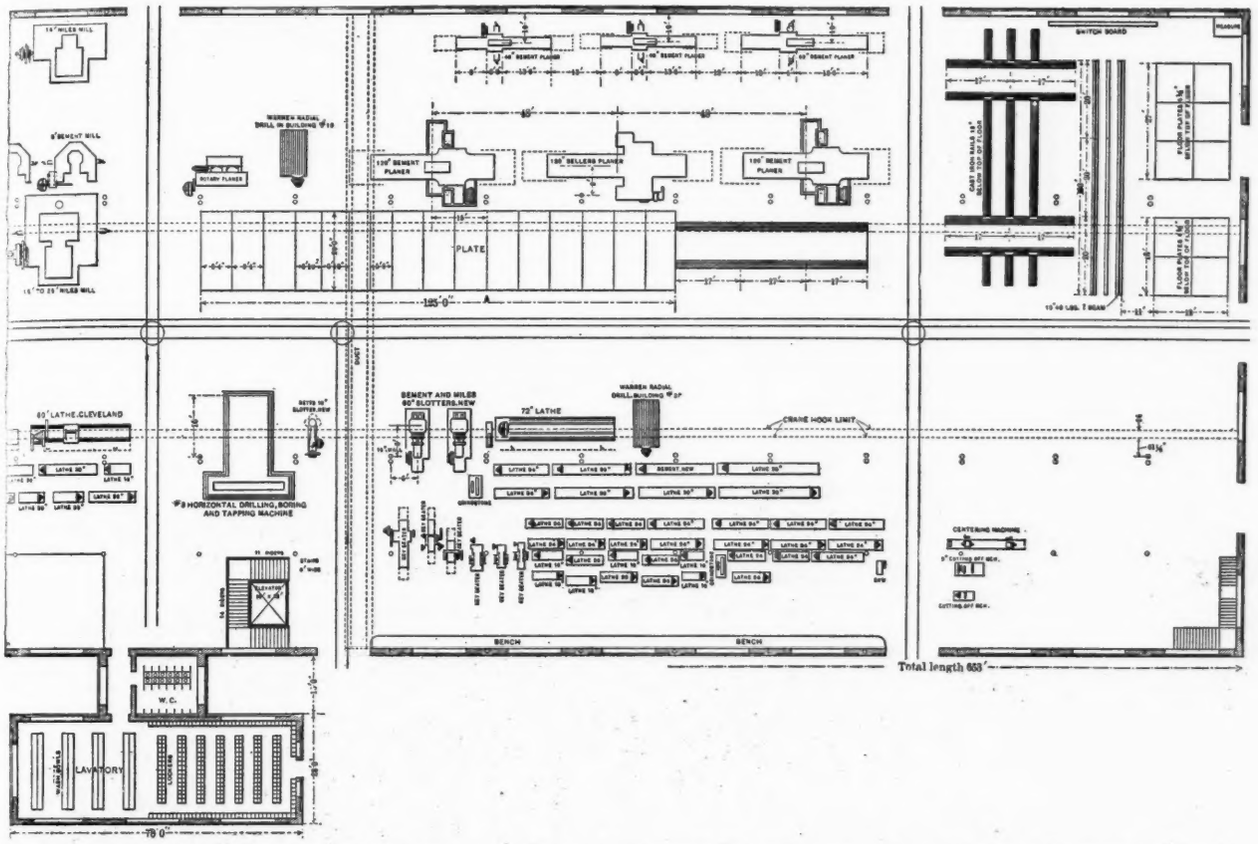
This great shop, which is soon to be extended 200 feet in length, is now 653 feet long and 166 feet wide, and is spanned in its middle section by three traveling cranes, one of 20 and two of 40 tons' capacity. In it is to be found an assemblage of machine tools of modern types which is probably second to none in existence anywhere.

Perhaps the best idea of this great building and the industries carried on within it may be had by considering it as a gigantic and complex tool, every part of which is designed with particular reference to the work it is to do and to doing this work with the utmost swiftness and the least cost. The building itself is admirably lighted, heated and ventilated and its sanitary condition is of the very best. Its design reflects high credit both upon Mr. G. E. Emmons, the works' manager; Mr. A. L. Rohrer, the electrical superintendent; Mr. John Riddel, mechanical super-

A GROUP OF BORING MILLS IN THE EAST WING OF BUILDING NO. 16.

intendent, and Mr. W. A. Pearson, supervising engineer.

The building is in three bays, and is a composite brick and iron structure. The central portion is 66 feet in width, the span of the traveling cranes in it being 65 feet. In the centre of the building the clear height from the floor to the bottom chord of the roof trusses is 46 feet and in the wings 40 feet. Foundations for all the columns are of concrete, while the floor consists of a six-inch bed of tar and cinders carrying a flooring of three-inch hemlock boards upon which is nailed a top-course of matched maple planks one and one-eighth inches thick. Skylights and side-lights are abundant, and the interior is admirably lighted in all parts.



GROUND PLAN SHOWING ARRANGEMENT OF TOOLS AND MACHINES IN WESTERN END OF BUILDING NO. 16, GENERAL ELECTRIC COMPANY'S SCHENECTADY WORKS.

PUNCHING, ANNEALING AND JAPANNING ARMATURE DISKS.

A gallery extends the entire length of the western wing of the building, this gallery being used for the mica department and for the smaller machine tools used in brass and copper working. A large number of commutators is made upon this floor. In the mica department the employés are mostly women, and this valuable material is handled here with little loss and to high advantage.

The accompanying plan view of the main floor of this building is necessarily made in two parts on account of its great size. This shows better than can any description the arrangement and location of machines. Three Morgan cranes of 65-foot span run the entire length of the middle bay of the building. Of these cranes, two are of 40 tons' capacity and one of 10 tons, the 40-ton cranes being fitted with five-ton auxiliary hoists. The larger cranes have a hoisting speed of 40 feet per minute, a cross traveling speed of 100 feet per minute and a longitudinal traveling speed of 225 to 300 feet per minute, the total rating of the four motors installed on each crane being 125 horse-

power, though, of course, this power is practically never called for. Direct-current motors are used on the crane, working at 250 volts, this being the standard voltage of the supply circuits which cover the major part of the grounds and buildings of the company. Distribution of current is made for lighting and power by means of three-wire circuits having 250 volts between the outside wires.

For driving line shafts of short length, operating groups of small tools, direct-current motors directly mounted on one end of the shaft are used. These motors range in capacity up to work 25 feet in diameter and have accomplished important results in speed and accuracy of work. Indeed, this form of machine is particularly adapted for work on large electrical machinery in which many round pieces of great size have to be machined.

In addition to these machines there are large numbers of milling machines, slotting machines, planers, lathes of many sizes, cold saws and other machine tools.

Perhaps one of the most important features of this shop and one that permits of all kinds form no inconsiderable feature of the equipment of this shop. Considerable use is also made of pneumatic hammers and drills for chipping and smaller work.

In this building also are assembled the laminated parts of the larger machines and some idea of the amount of laminated iron consumed may be gathered from the fact that the average consumption is 25 tons per day. It may be stated here that about two years ago the consumption of raw materials by the company at its three works amounted to 3,000 tons of iron and

FIVE O'CLOCK IN THE AFTERNCON AT THE GENERAL ELECTRIC COMPANY'S WORKS. THE HEAD OF THE HOMEWARD BOUND ARMY.

are of slow-speed multipolar construction. All the larger tools are equipped with individual motors, in general directly connected, although some belted motors are still used, and these machines are controlled by the use of field rheostats. By weakening the fields and connecting the armature either to one side or across the two sides of the three-wire system, a wide variation of speeds is easily produced. Each motor is provided with a small panel switchboard and upon many of the larger tools an electric brake is installed, permitting the tool to be stopped instantly in case of accident or emergency.

Much use is made of boring mills, a number of these machines made by Bement, Miles & Company and the Niles Tool Works Company being in use and all of them being direct-driven by motors coupled to the machine. These machines the greatest rapidity of work is a provision whereby, in the case of large work, the tool may be carried to the work instead of the work being brought to the tool. This is accomplished by the use of an immense floor-plate of cast iron, 170 feet long and 20 feet wide. This plate is fitted with T-shaped slots by which work and tools may be rigidly held in position, much in the same way that small work is ordinarily bolted to the bed of a planing machine. The beams under the floor are supported by a solid bed of concrete and the top of the plate is accurately lined and surfaced so as to insure the greatest rigidity and accuracy of adjustment.

An interesting machine is a rotary planer which enables many pieces of large size to be planed simultaneously with the greatest economy of time and labor. Portable drilling machines and small tools steel and 1,000 tons of copper per month. A few months later the Schenectady works alone, owing to increased output, had passed this mark.

Perhaps the most striking impression that this great machine shop leaves upon the visitor is the exact system with which all its operations are conducted, the absence of confusion which may be noted in its various departments, and the apparent fact that nothing in it was constructed for show—everything was made for use. Indeed, nowhere about the works is there any evidence that an attempt has been made to produce an impression upon the visitor. The works were built and have expanded along the most simple and practical lines, with the result that appearance has invariably been sacrificed to utility. Another feature which impresses the visitor forcibly and gives him an excellent con-

LOOKING EAST AND WEST FROM THE CENTRE OF THE GENERAL ELECTRIC COMPANY'S IRON FOUNDRY.

ception of the vastness of the establishment is that, while 900 hands are employed on the floor of this machine shop, it looks almost untenanted as one surveys its great expanse from a second-floor gallery. Indeed, everywhere in the establishment one notices a singular disproportion between men and machines. The works are crowded with machines but among them even the great army of operatives appears small. This result has been attained largely by the use of every appliance known to the mechanical arts by which labor may be saved.

A most interesting place is the building in which punching machines produce the innumerable shapes of laminated iron used in the construction of armatures and field magnets. Perhaps the largest number of such machines working together anywhere may be found in the armature shop, their output being, as noted above, 25 tons of laminated pieces per day. These punchings, after being annealed in large cast-iron boxes, are japanned with great rapidity by an ingenious machine consisting of rollers like those of a printing-press by which the japan is applied and an endless slat belt running over blowers upon which the pieces are dried. A disk is japanned by this apparatus in about 30 seconds, coming from it ready for assembling.

In the armature-winding department the work is almost automatic. There is practically no hand winding to do and this building is filled with machines for the manufacture of the shaped coils which are at present in use. These coils are wound up of round or square wire, as the case may be, shaped in the machine, taped with dry tape by hand and insulated with compounds varying in quality according to the work which the coil is to do. For high insulations the coils are placed in a vacuum pan from which the air is exhausted and into which, after exhaustion, a hot liquid compound is allowed to flow. To be certain that this fills all the inner spaces of the coil, pressure is then applied to it. A number of highly ingenious processes is also employed in this department for the production of the almost countless forms of coils and windings employed in the various types of machines.

American Electrical Exports—II.

By Arthur Stanley Riggs.

SOUTH AMERICA.

Conditions in South America differ widely. In the majority of cases the country is undeveloped, and has no facilities for short-distance transportation but horses and mules, the steam railways being inadequate to the needs of the people. In some of the large cities like Lima, Peru; Valparaiso, or Rio Janeiro, there are large electrical plants now in operation, but taking the country as a whole there is little enterprise outside of the large business centres. The Spaniard is not an experimenter, being well content to run along under present conditions when his factory, or whatever business he is identified with, pays. In order to reach such a man in the most effective manner, the exporter must not only have a capable representative in the field, but must be prepared to demonstrate, no matter what the cost, the exact reasons why his machinery or apparatus is better adapted to making money than what the Spaniard already has. To do this catalogues must be carefully made out in Spanish—in the Spanish that is spoken in South American countries. The catalogue must also be couched in terms that are familiar and which deal with trade according to local conditions. A simple American catalogue translated into Spanish and mailed to the prospective buyer is practically of no value, as the receiver looks at it, possibly says it is good, and tucks it away out of sight in his file without so much as thinking of buying. The advertising successfully of products to be sold is an art of so great an extent and so many departments, that it requires a separate staff to take care of it, and American manufacturers would do well to get hold of some bright, educated South American, who is conversant with both Spanish and English, to take care of their advertising for them. As a manufacturer recently said: "Mexicans and Spaniards have to be pounded, and pounded hard, before they buy anything. Until it is proven that the mule or horse costs more, the electrical railway will never meet with much success as an interurban or interplantation means of transportation. At the present time many of the large coffee planters in the interior pack their products on the backs of mules, form a transport train and send them to the city or to the coast, where they can be shipped to foreign ports. Short-line electric railroads which would enable this shipping to be more speedily and cheaply done would not only make money for the promoter, but would be a decided step in the right direction in the development of the country and obtain the interest of the natives for the expanding civilization of the North. The probability is that the development in most of the South American countries will be telephone and lighting, first and foremost, followed after a few years by the electric railway. The fine water powers and natural resources of the country will contribute largely to the success of such an undertaking, and it is also probable that the governments of many of the more important Pan-American states will grant valuable franchises and concessions for a very nominal consideration. The Central American Republic of Guatemala may be cited as an instance of this, as the Guatemala Telephone Company is understood to have received permission from the government to string its wires on the same poles that bear the government telegraph lines.

The fertility of Pan-America, and its natural resources—it having large mineral deposits of great value—will enable the projectors of railway lines to branch out in other undertakings than simple traction. The quantities of coffee, bananas, fruits and other products will be very heavy, and, too, there will be considerable business done in the transportation of passengers, but this will not amount to anything like the freight traffic. Taken altogether, the opportunity presented is good. The time may not yet be quite ripe for the enterprise, but so long as a competent American or European can be found to push any such undertaking through to a successful climax it is practically an assured success.

RUSSIA AND CONTINENTAL EUROPE.

Russia's future is believed to lie almost entirely in railway construction, both steam and electric lines being planned. American machinery, steel, railroad supplies and lamps are pouring across the water in a steady stream which increases with every year. The Russians appreciate the fact that American goods, when bought of a reliable manufacturer, are always of standard quality, and although the price is high, it is not prohibitive. In many cases where foreign competition has entered the field with us, we have been able to furnish quicker deliveries and make better prices in general than our rivals. The recent tariff which has gone into effect as a retaliative measure against the duties imposed by the United

States Government on Russian products, will not largely affect our trade, as it is not expected that the steel and iron manufactures and agricultural implements, which are chiefly affected by M. de Witte's order, will reach more than a gross amount of six millions a year. Considering the vast amount of our export trade, these figures need not be looked upon with alarm. The considerations which affect Russian buyers are chiefly service and quality. All that they have purchased here is expected to do more, last longer and be lower in price than other foreign manufactured articles. While it is difficult to say exactly in what lines the exports of the United States to Russia will increase in the immediate future, it is believed in a general way by persons competent to judge that there will be more and more electric lighting material sent there, much of this coming from Pennsylvania and New York.

SCANDINAVIA.

In Sweden, Norway and Denmark, the situation is somewhat different and may be said to be governed chiefly by French and German exporters. The development is uncertain; no one knows what it will be, but from the fine water powers Scandinavia possesses it is believed that there will be considerable work done before 50 years are gone by in the erection of heavy power transmission lines, particularly for working lighting stations and railway plants in cities like Copenhagen, Christiana, Christensand and Stockholm.

THE UNITED KINGDOM.

Possibly the most unique feature in considering export matters is the demand for American goods in the United Kingdom, and particularly in Great Britain itself. Consular reports from Birmingham, London, Liverpool, Manchester and other great cities have shown that the demand for certain articles there is beyond the power of the British manufacturer to fill. As a fanciful illustration of this may be cited the demand for ladies' shirt waists. The consul who reported this matter in particular threw up his hands and declared that, although British haberdashers made such garments, they were the despair of every woman who tried them on; in fact, no American woman would recognize them for shirt waists. They were lacking in fit, cut, style and material. The percales and fine lawns that the American woman is accustomed to wear do not seem to lend themselves to British tailoring methods. It is the same in other lines of manufacture. American builders have captured steel contracts and usurped the rights of the British manufacturers and builders time after time. The quality of steel submitted, the time required for construction and delivery, and, in short, all the details which go to make up a thoroughly successful and businesslike contract have been American in many instances.

It is a certainty that the British technical press would not take so gloomy a view of American competition as it does were there not good grounds for fear. Time after time within the past few months the British manufacturer has been cautioned by his technical papers to wake up. Figures have been given showing the percentage of orders captured by Americans, and still there seems to be a steady stream of orders flowing over to this country. Two large electrical concerns, which are thoroughly American in their methods, management and the material they use, are doing an enormous business through their London offices, while their factories are located in other cities on the island. The United Kingdom has for so long been the leader in the export trade that it is only natural for the shock of discovery at our rapid encroachments to be severe. Her career as the leader may not be terminated for some years to come, but with the United States, Germany, France and even little Japan steadily trespassing upon the time-honored rights that the English mind holds so dear, and which are so nearly a part of his tenacious nature, the empire, as a manufacturing unit, must change its methods and from waiting for the orders to come in must go out and get them.

THE PHILIPPINE ISLANDS.

Development in the Philippine Islands may be said to be at a standstill at the present time on account of the operations of our troops against the Filipinos. The country being more adapted to the manufacture of products other than mechanical or electric apparatus, and being largely given up in time of peace to farming and tobacco-raising, it is hardly likely ever to become a market for much electrical apparatus. In the larger cities on the island—towns like Manila, Iloilo, Cavite and Dagupan—some progress will undoubtedly be made in electric lighting and telephone matters. In the opinion of Mr. Carolan there may come a time when the big tobacco factories, where the famous Manila cigars and cigarettes are made, will be lighted by electricity. He thinks, also, that there is a field for the telephone to a moderate extent, but only in the cities proper, the outskirts being settled by people who have practically no necessity for rapid communication. The electric light may come to be adopted on the farms, but this statement is only conjectural. The principal products of the island are tobacco, hemp, matting and some coffee. The means of transportation now are horses and mules, the China ponies being greatly in evidence. There is little likelihood that, except in the cities themselves, the electric railway will meet with much favor. Manila possesses a tramway at the present time, which, in the course of a few years, will probably be turned over to an electric system, and a line from Cavitè might pay. But the lack of wealth, the unsettled condition of the country and the nature of its products, development along electrical lines will be slow, and possibly in the nature of an experiment.

THE BRITISH COLONIES.

Canada—Being a British possession, the Dominion naturally prefers goods manufactured in the United Kingdom, but it is nevertheless a fact that a very considerable portion of the arc lamps used for lighting in several of the large cities were made in New Jersey, while the Canadian General Electric Company is a thriving corporation whose product and output are very material factors in the commerce of the Canadian provinces. In spite of the preference for British goods the prices offered the Canadians by American manufacturers have to a great extent obtained the business and, unless a radical change is made in British business methods, are likely to do so for some time to come. The development in Canada will probably be along the lines of telephone and electric lighting industries.

Africa—South Africa is a very good field at present but a good proportion of the trade is going to Germany. The development there seems to be principally in electric lighting supplies and the territory is good because it is new. The material and machinery offered by the German manufacturers is certainly no better than that produced in the United States and the reason for the adoption of German goods may possibly lie in the bond of sympathy between Briton and Teuton, but is more probably the result of lower prices and quicker deliveries. It is certainly necessary that Americans should delay no longer but get their representatives at work in the field properly equipped with the necessary information and samples. Germany has already done this to a greater extent than we have and the result is manifest.

Australasia—Here the situation is about equally divided between tramways and telephones. The local parliament (at Sydney, N. S. W.) has called for tenders for changing the street railway lines now in operation in Sydney over from horse to electric power. Considerable activity is manifested in telephone and telegraph lines and supplies and it is to be noted with pleasure that we are obtaining a good portion of the trade.

Much British machinery is being used, but the promising condition of the import trade, particularly with reference to the United States, augurs more business in the future along the same lines.

With the other colonies it is much the same. The West Indies are using large quantities of railway supplies, steel and similar finished products. Bermuda is not advancing very rapidly, though there is activity in the British Navy Yard. The Bahamas have their future principally before them and the attitude of the people is friendly in the main to any enterprise for the development of the islands.

A cursory review of the entire situation shows that the facts deduced are not in the light of invidious comparisons, but merely a plain statement of facts. The American nation as a manufacturing unit seeks to increase its market, but does it in a perfectly legitimate way, endeavoring to crowd no one out. Business competition is recognized as honorable, having the prestige given it by the long experience of British manufacturers; and though we may be somewhat keener and more alert to seize opportunities through our enterprise, we got our training from them in the first place, merely having carried their principles a little farther. The infant is gaining muscle, and the parent is not gaining strength. The traits that made the Anglo-Norseman the victor of the world 500 or 600 years ago are not the ones to win commercially to-day. The bulldog is an excellent fighter,—he holds on until killed; but the fox terrier is the strategist. German competition in entering the field is of decided advantage to us. The very fact that a keen, alert rival is in the field with material fully as good as ours, business methods that are above reproach, and a good-natured willingness to accept the imposed conditions is a stimulus which we should not fail to appreciate. It is but natural to desire all the business we can take care of, and so far we have not had as much as that. Every German manufacturer feels exactly the same, doing his best to obtain contracts wherever possible, and under the spur of our determined and energetic rivalry is doing more that he otherwise would have done. England's business methods are somewhat different. Accustomed by long usage to being sought out as the head and centre of intellectuality, commerce and development, she is not so inclined to strain every nerve after business, but this condition is not to be lasting. If she is to have her share in the markets of the world she must adopt different methods and doubtless is doing so now. The customs of many years are very hard to overcome and it will be with difficulty that the English manufacturer will meet the swift and certain figures and terms of his competitors. The bulldog spirit, however, that he has always manifested will come to his rescue and without doubt British manufacturers will soon be seen coming to the front again and forcing the competing world to still further exertions.

Views, News and Interviews

An endowment of $1,000,000 was made by the late Philip D. Armour, before his death, to the Armour Institute of Technology, of Chicago, which will be affiliated with either the University of Chicago or the Northwestern University.

One of the thieves who have recently stolen many thousand feet of trolley-wire from the North Hudson County, N. J., trolley line, was captured by the boss lineman, and is believed to be the leader of an organized gang. The thief resisted arrest, but the lineman succeeded in lodging him in jail.

In New South Wales, Australia, the wages paid for skilled machinists average $10.84 per week; for electroplate finishers, $15.84; for coppersmiths, $15.60; for engineers, $15.84, and for brass moulders in the engineering trades (bench hands), $10.56; coppersmiths, $12.48, and engineers, $13.32.

A gentleman in Montclair, N. J., ran a small needle into his right hand several years ago and efforts to remove it were unavailing. Since that time he has suffered intense pain in different parts of his body at intervals, and recently was annoyed by a stinging sensation in one of his legs. A physician examined the leg with X-rays and found the needle, which, on being removed, was found to be as bright and clean as when it entered his hand.

A bill recently introduced into the Legislature at Albany, N. Y., will, if passed, make the police telegraphers eligible to the actual pay of a sergeant, and promotion on examination to the rank of captain. Prior to the enactment of the charter of Greater New York the telegraph operators ranked as sergeants, but under the new charter they are simply telegraph operators drawing a salary of $1,900 per annum, besides losing the chance for promotion and their eligibility to try examinations for the captaincy. If the bill becomes a law, the telegraph operators will receive $2,000 per annum.

A good story is told of a London trolley-car conductor, who had just discovered that one of his passengers had given him a bad shilling. A lady who was sitting in the car beside a small child paid but a single fare. The conductor was irate and said: "Look here, ma'm, you will have to pay for the child as well as yourself."

"I won't," answered the lady.

"Then I'll put the child off," replied the conductor, as he rang the bell.

"You don't dare," flashed the woman.

The conductor lifted the child and placed her outside the car. "There," he remarked, feeling somewhat better, "you will find your child on the pavement."

"My child?" she snapped. "It isn't mine."

"Whose is it, then?" gasped the conductor.

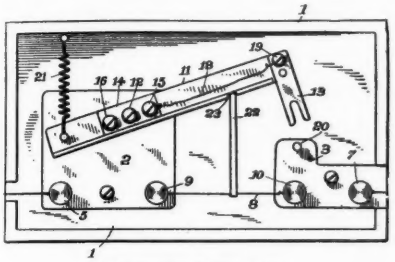
"I haven't the slightest idea," she coolly answered.

Then the child's mother, who had been engaged in an exciting discussion with a friend over the merits of a new dress, awoke to the fact that her child was missing, and the fireworks that scintillated around the conductor's head made him think that a whole battery of fuses had blown out all at once.

M. Camille Flammarion, the well-known French astronomer and author, has devoted considerable time to the study of the effects of lightning on men, animals and other objects to illustrate the freakish manner in which the mysterious fluid acts. During August of last year a young man was struck by lightning and carried a distance of 50 yards without being in the least conscious that anything unusual had happened to him until the lightning threw him against the wall of a house, where he received a slight wound in the knee. Two cows, which were 200 yards from him when the bolt fell, were killed. Three soldiers are said to have sought refuge under a linden tree during a storm, and all three were struck by lightning and killed as they stood side by side. Though dead, they maintained their erect position, but their bodies, when touched, crumbled away into dust. Two peasants were preparing to eat their breakfast, when suddenly the dishes were thrown to the ground, the bread, cheese and fruit vanished from the table and they themselves were covered with straw. On another occasion a man walking through Nantes was suddenly enveloped in lightning, yet remained uninjured. When he reached home, however, and opened his purse, which had contained two pieces of silver and one of gold, he found that the gold piece had vanished and in its place was a silver piece. The lightning had, in fact, pierced through the leather of the purse and had covered the gold piece with a coating of silver taken from the other two coins.

Recent Electrical Patents

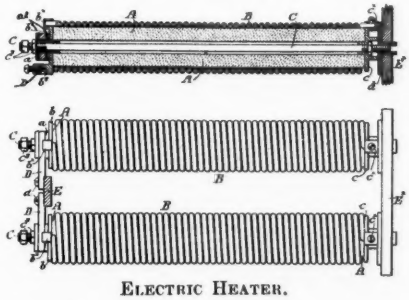
A new fuse box that automatically closes the circuit again after the fuse has been blown, has been the subject matter of a patent granted to John F. Lyons. He provides a pair of terminals to which are fastened the line wires, and are connected



ELECTRIC FUSE BOX.

by the usual fuse wire. Pivotally mounted upon one of these terminals is a bridge which is adapted to be swung so that it will contact with the other terminal. A spring secured to this bridge is adapted to force the same into its operative position. This bridge is made of some insulating material, the contacting portions being of metal and connected by a fuse wire. It is normally held open by means of a rod that bears against its under side and rests upon the fuse wire that directly connects the terminals. As long as the fuse wire is unbroken therefore the pivot bridge will be held open, but should the fuse be blown the rod will drop from under the bridge and the spring will throw it into contact with the opposite fuse block, whereupon the current will pass through the fuse wire carried thereby.

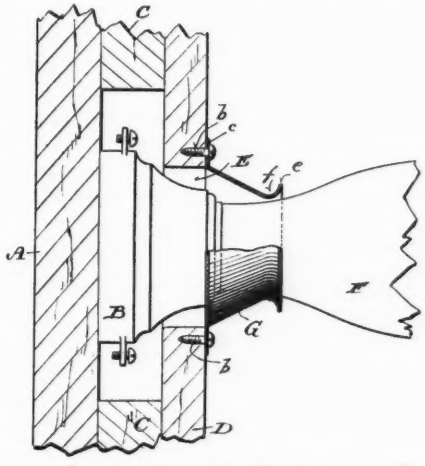
A resistance coil of novel construction consists of a tubular core of fireproof insulating material, such as asbestos or porcelain, upon which are wound the coils of resistance. Through the hollow in-



ELECTRIC HEATER.

terior of the core a rod of conducting material is passed, having at one extremity a cap or end piece, also of conducting material, and in electrical contact with the rod. This end piece has on it a lug with a set screw for the attachment of one end of the coil. At the other end of the core is a second cap of conducting material mounted concentrically with the rod but insulated therefrom by a bushing. This cap also has a lug for the attachment of the second end of the coil, and another lug which forms a binding-post. The rod is threaded at its upper end to receive nuts, one of which serves to clamp together the coil with its caps and insulating bushing and washers as a whole, and the other serves for the connection of electrical conductors, thereby forming the second terminal of the coil. Suitable brackets are provided for supporting the entire device. By this arrangement a great many of these coils may be placed together, as they occupy but little space. The inventor of this device is Arthur C. Eastwood, of Cleveland, Ohio.

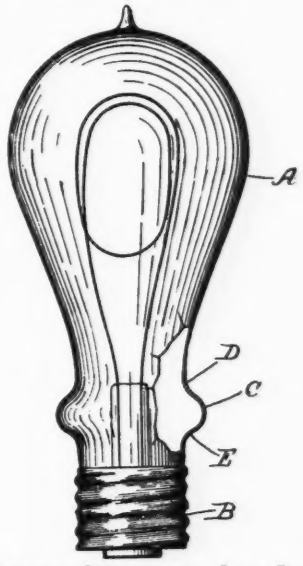
For the purpose of protecting the metallic fastening portions of incandescent electric lights, Edward Eckl, of Mil-



INCANDESCENT LAMP PROTECTOR.

waukee, Wis., has devised a simple construction on which he has been granted a patent. The device is intended especially for outdoor work such as electrical signs. A base board is provided upon which the socket is secured, and a pair of cleats are placed upon each side of the socket. Secured to these cleats is a cover having an opening in it in which is arranged the outer end of the socket that receives the lamp. Surrounding this opening is a collar or bushing through which the lamp is passed; this collar may be made of metal or porcelain and has a base flange through which securing screws are passed. It is contracted at its outer end and provided with an outwardly flaring flange. In this manner, the socket and metallic portions of the lamp are completely protected from the elements.

Another inventor has also been working on the above idea, and accomplishes it in a very much simpler manner, although, perhaps, it does not afford as much protection. In his construction, it simply makes an outward bulge on the base of the lamp, this bulge overhanging the metallic portion. It is claimed for this that the moisture or other deleterious substances are checked by this annulus or



PROTECTED INCANDESCENT LAMP BULB.

rib and drop off the globe before they come into contact with the metallic portions of the lamp. The inventor is Charles A. Chase, of Chicago, Ill., who has assigned his entire interest in the patent to the General Incandescent Lamp Company, of Cleveland, Ohio.

The Stanley Electric Manufacturing Company.

The Stanley Electric Manufacturing Company at its annual election of officers held recently at Trenton, N. J., reelected Dr. F. A. C. Perrine president. Under Dr. Perrine's energetic management the affairs of the company have progressed rapidly and a very large extension of the works at Pittsfield, Mass., has been found necessary and is now being carried to completion. The other officers of the company elected were W. W. Gamwell, treasurer, and W. Taylor, secretary.

During December last the imports of electrical goods and apparatus into English ports were £147,205, as compared with £149,327 in the same month of 1899. For the entire past year the value of such imports is returned at £1,205,965. Upwards of 50 per cent of such imports were from the United States.

THE CONSTRUCTION OF SMALL TELEPHONE EXCHANGES—IV.

BY A. E. DOBBS.

THE HANGING OF CABLE SPANS.

One of the mistakes made by many of the new companies is in purchasing wire upon which to hang the cable that is inadequate to perform the work required of it, and yet this is a matter that requires more thought than is generally given it because none but those construction men who have had a long experience appreciate just what the strain on a span wire really means, or what the ultimate result of a continuously heavy strain in all kinds of weather really means to a wire that is pulled up to the full limit of its carrying capacity.

We have sometimes seen 100-pair cables hung on ordinary five-sixteenths strand which could not be drawn tightly enough to support them properly, with the result that there was five or six feet of dip in a comparatively short span which, to say the least, looks very slovenly. The wire used for cables is generally made up of seven strands twisted together, as shown in Fig. 3. An ordinary half-inch strand of this kind has a breaking strength of from 8,000 to 10,000 pounds and nothing smaller or weaker than this should be used in hanging a 100-pair cable.

These "messenger" cables, as they are called, should be galvanized with the same care as the best wire used in construction work and subjected to the same tests as used for what is commonly called double galvanizing, namely:

"The wire to be dipped in a strong solution of blue vitriol (sulphate of copper) and allowed to remain therein for one minute, withdrawn and wiped dry; this operation to be repeated four times, when, if the wire remains black, or bright, after the fourth immersion, it shows that the galvanizing has been well done, but if it shows a copper color, it shows that the zinc coating is too thin, and such wire will be rejected."

If strand wire is purchased from the jobbing houses, it will be necessary to specify this test or the chances are that the order will be filled with a cheaper wire, as competition will sometimes make them figure in the cheapest wire they have in stock instead of the best, although they will give a price on the best if asked. In drawing up specifications this must be clearly understood.

Even a cheaper galvanizing can however be preserved a much longer time by covering it with a mixture of creosote and raw oil which will also make the cable run smoother as it is hung up and therefore this mixture will be an advantage applied to any span wire even though well galvanized.

The common wire which is carried in stock by supply houses is a mild steel, and when hung up in the air, even though drawn up tightly at the beginning, often begins to sag down after a short time due to the elongation and for the best class of work it is better to use a higher grade of steel which is made in four different grades, the following table showing the different breaking stresses, and comparative prices of each at the present time:

Fig. 3

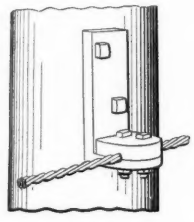


Fig. 4

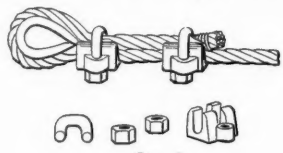


Fig. 7

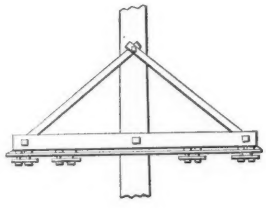


Fig. 5

Fig. 9

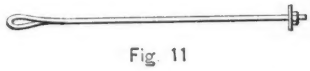


Fig. 11

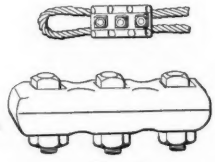


Fig. 6

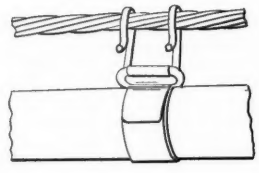


Fig. 8

FIGS. 3-11.—TELEPHONE LINE MATERIAL.

Seven strands, No.	Approximate diameter.	Approximate weight per 100 feet.	Ultimate Strength. Mild steel.	Siemens-Martin.	High strength.	Extra high strength.
8	1/2	52	8,320	11,000	18,000	27,000
9	9/32	42	6,720	.....	.....	22,500
10	5/16	36	5,720	9,000	15,000	22,500
11	11/32	29	4,640	6,800	11,500	17,250
12	3/8	21	3,360	4,860	8,100	12,100
13	13/32	16	2,560	4,380	7,300	10,900
14	7/16	12	1,920	.....	.....	.....
15	1/2	10	1,600	3,950	5,100	7,600

The comparative prices are the list per 100 feet, but as prices are changing they are only given in order to form a basis of comparison as to first cost, and may be estimated at the following rate:

Diameter.	Size of strands.	Prices. Mild steel.	Siemens-Martin.	High strength.	Extra high strength.
1/2	8	$2 40	$2 70	$3 95	$5 50
5/16	10	1 80	2 20	3 45	4 60
11/32	11	1 50	1 75	2 70	3 55
3/8	12	1 15	1 30	2 10	2 70
13/32	13	90	1 05	1 75	2 10
7/16	15	60	95	1 50	1 90

If this strand is purchased by the pound the purchaser is liable to pay more, or get a lighter weight wire than he bargains for, as seven-strand No. 9 can, by twisting somewhat closer, be made to look as large as a seven-strand No. 8, and weigh nearly as much, but it will not have the strength. Wire strand, therefore, should therefore be ordered in terms of length instead of weight and the size of the strand specified, as well as the diameter; although if ordered as 7 by 8 (seven-strand No. 8) you will get the wire wanted, no matter how it may be twisted.

Therefore in buying strand it will be well to specify as follows, and to see that it complies with the specifications when it arrives.

"Prices are asked on —— feet of —— (give size) strand or messenger wire, the same to be composed of seven strands of ——(size of wire in the strand) wire, of a strength equal to —— (mild steel, Siemens-Martin, high strength or extra high strength or in pounds if preferred), the same to be heavily galvanized to stand the usual acid tests (insert the test given above if desired)."

This will insure the purchaser getting what he pays for and there will be no chance for any misunderstanding on the subject.

The stronger the wire the more difficult it will be to handle, as it is harder steel, but the difference is very little to a lineman who understands his business, while the harder steel will not sag down as the milder steel is apt to do. Now, while the writer would recommend the stronger grades of steel, he would not recommend that purchasers should buy a much smaller size of strand, as there is a limit beyond which it is not safe to go. Thus a nine-thirty-second strand of extra high strength steel is stronger than the one-half-inch mild steel, but the larger strand, on account of its greater size, will resist corrosion longer, and for 100-pair cables it is not a good plan to use any wire smaller than seven-sixteenths. In the total cost of the cable the strand plays

but a very small part, and it does not pay to allow a safety factor of two, which some manufacturers recommend, when you can have a safety factor of three or four just as well as not. Then, if the cable terminal poles are well anchored, there is no reason why the cable should not stay pulled up in place for a long term of years. Where a cable system is adopted—and it should be in all exchanges of any considerable size—the work should be put up permanently. This telephone business is no child's play and we fear that some of our friends do not take it seriously enough to make a complete success of it.

OTHER CABLE FITTINGS.

To hang the cable span, or messenger wire, as it is sometimes called, on the pole

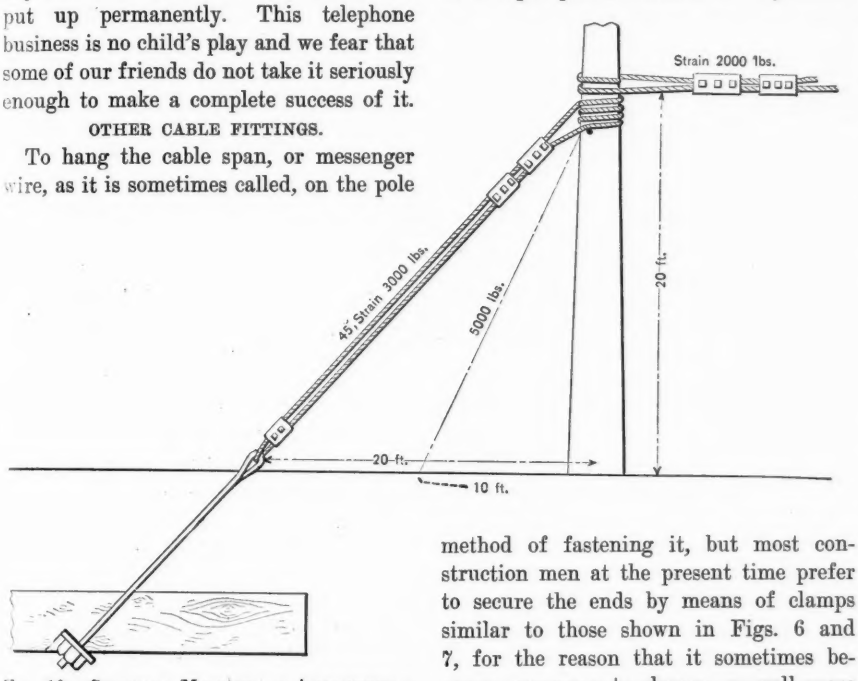


FIG. 10.—SHOWING METHOD OF ANCHORING A DEAD-ENDED MESSENGER WIRE

where only a single span is required, some such a device as that shown in Fig. 4 is the most suitable so far devised. This should be galvanized if it is possible to obtain it so, but if not then it should be saturated in creosote or raw oil in order to prevent electrolytic action between the plain iron and galvanized strand which is otherwise likely to take place.

When, however, two or more cables are to be strung, then an angle iron arm similar to that shown in Fig. 5 should be used. As the length of this arm is about 48 inches there is room on it for six cables by placing the messenger wires six inches apart, and still leaving a spacing of 20 inches in the centre for the linemen to pass between on their way up the pole. While on this subject of hangers it might be well to mention that one company uses the ordinary three-bolt guy clamp shown in Fig. 6, securing it to the pole by means of a lag screw through the centre hole and using the two end bolts to clamp the wire. This can only be used on a straight line however, where there is no greater strain upon it than that of holding the weight of the cable, although in turning corners it may be used to advantage, as properly placed the span wire will not make as abrupt a turn, as there will make two moderate angles in the wire instead of one acute one, as in the regular form of cable hanger.

In making up the ends of the cable span, the ends can be secured in two ways: First, by means of a half splice, similar to a rope splice, which is a very secure method of fastening it, but most construction men at the present time prefer to secure the ends by means of clamps similar to those shown in Figs. 6 and 7, for the reason that it sometimes becomes necessary to change, or pull more slack out of a guy or messenger wire, and at the same time to save all the wire there is, which the clamp readily allows.

In the selection of a cable hanger there are several different kinds to choose from, but those made of solid or soft cast iron are not desirable, because, in pulling the cable through, it sometimes happens that the men engaged in "passing cable" get careless or the cable is pulled faster than they can handle it and a hanger catches at a span hanger, and the cable is almost, or entirely, cut in two before the signal can be passed to stop, or release it; besides, a rigid hanger is liable to injuriously compress or, by rusting, otherwise injure the cable. A hanger therefore should not injuriously compress the cable nor should it be so strong that it can not give should a strain be thrown upon it, and these conditions are best met in the hanger shown in Fig. 8, which consists of a strap of sheet zinc locked in position by the hook attachment. As there are two or three variations of the zinc strap hanger on the market, this notice can not be construed as an advertisement. A very neat and efficient hanger, though rather expensive in the matter of labor, is that shown in Fig. 9, which is simply a cable lashed with marlin twine. If the ends are carefully concealed, as they should be, this makes the neatest method of hanging a cable, the tying in being done after the cable is pulled through.

ANCHORS AND GUYS.

Anchors should be placed before the messenger wire is pulled up, and the messenger wire should generally be carried back one section further than the cable itself, in order to leave the cable pole clear, unless it should happen that there was only one messenger wire, in which case it may be dead-ended at the cable pole.

One of the most convenient anchors to be found is a railway tie, which may be buried from six to ten feet in the ground, according to the strain upon it; it may also be weighted with rocks or set in cement to hold it more firmly in place. The strain upon a messenger wire, properly pulled up, is from 2,000 to 3,000 pounds, and the size of the anchor rod should be calculated for twice this amount at least. In order to understand this more clearly, let us refer to Fig. 10, which shows an anchor holding a dead-ended messenger wire. Let us suppose the strain on the messenger to be 2,000 pounds and placed at a height of 20 feet from the ground and the anchor placed 20 feet back from the pole, which gives an angle of 45 degrees to the anchor wire. By actual experiment it has been demonstrated that the strain on the anchor would be one and one-half times this, or 3,000 pounds, and the closer the anchor is placed to the pole the greater the strain. Thus leaving the messenger still 20 feet from the ground and moving the anchor in to 15 feet from the pole, increases the strain on the pole to 3,500 pounds. Bringing it in to within 10 feet of the pole brings it up to 5,000 pounds, and within five feet to 8,000 pounds.

It must not be supposed that the pole will hold any of this strain, as it should not be expected to, for all the weight should come on the anchor.

In order to keep the strain on the wires from compressing the pole it should be protected with a strip of galvanized sheet iron tacked to the pole underneath the turns of wire.

For holding the strain of two messengers, one three-quarter-inch rod is sufficient if placed far enough away, but for more than this, a rod of 10 feet long and one inch or more in diameter should be used. These rods should be galvanized and have the eye at the upper end well welded to prevent possible pulling out.

BRITISH ELECTRICAL NEWS.

[From a Special Correspondent.]

Professor J. A. Fleming, who is well known across the Atlantic, has brought down upon himself a heap of criticism, adverse and otherwise, by an article in the current number of the *Nineteenth Century—and After,* a popular technical monthly magazine, entitled "Official Obstruction of Electric Progress." In this he attacks the British Government in no uncertain manner, and starts off as follows: "In detailed improvements or adaptations we have not been backward, but if we except the inventions of Lord Kelvin in connection with submarine telegraphy, Mr. Swan in electric lighting and the contributions which the late Professor D. E. Hughes made to telephony by the invention of the microphone, it is difficult to name any first-rate new adaptation of electrical discovery for practically useful purposes in the last 30 years which has not come to us from non-British sources. . . . Why should the transformation of electrical knowledge into useful arts go forward more rapidly in other countries than in Great Britain?" For this state of affairs he blames the government of 1870—which created the telegraph monopoly—and the subsequent governments generally on account of their partiality for municipal trading and the Board of Trade. He stigmatizes all government officials as slow, cautious and fond of keeping themselves well in the foreground, with an eye to promotion, rather than any love of furthering the interests of the nation. A bone of contention made much of in his article is the 10 per cent royalty which the National Telephone Company has to pay to the Post Office, which, up to now, has amounted to £1,081,490, and he makes the following statement in connection therewith: "When the telephone first made its appearance the technical experts of the Post Office laughed at it as a toy. It was only when they were convinced of its utility by hard facts that they set in motion the legal machinery which enabled them to bring it within the grasp of the Telegraph Acts."

Naturally Professor Fleming covers a vast field of electrical enterprise and in the light of his recent close connections with the Marconi Wireless Telegraph Company it is not surprising that he should belittle the Post Office system of telegraphing without wires. This consists of two large coils of wire at the sending and receiving stations, but the Professor rather sneeringly remarks that this entails the employment of more wire than if the two places were connected together in the ordinary way. It goes without saying that the article has been freely discussed in the press and it is evident by the mixed criticisms it has called forth that Professor Fleming is not exactly isolated in his denunciations.

Apropos of Professor Fleming's connection with the Marconi Wireless Telegraph Company, it is interesting that he should have announced, a week ago, that Marconi has succeeded in transmitting over a distance of 200 miles; *viz.*, from St. Katherine's Point, Isle of Wight, to the Lizard Head. He further publishes the fact that regular communication is now established between these two points and that two or more messages can be received simultaneously at either end. Without doubt this is an important advance, and surely it is time that some extensive commercial application was made.

From present appearances automobilism will be well served this season. The Automobile Club of Great Britain and Ireland has arranged to hold another exhibition in London during May, as well as to undertake its 1,000-mile trip through the country. In addition, a number of meetings will be held at the Glasgow Exhibition, where, by the way, a large amount of space will be reserved for this industry. I hope to deal with all these in due course.

Speaking of the Glasgow Exhibition reminds me that great progress is being made in this Scotch town with the international exhibition there. An immense amount of space is taken up by the buildings, which are practically completed. Details, up to the present, have not been very plentiful, but it has transpired that both electric and gas lighting will be utilized, the latter chiefly in the central portion of the grounds. An offer of 10,000 yards of aluminum for outside overhead arc lighting, by the British Aluminum Company, has been accepted. The exhibition is down to open in a few months' time and I hope to have an opportunity of describing the principal electrical features later on. This is the first international exhibition of any note over here since 1862.

In contrast to the opposition to the National Telephone Company in London, and the Postmaster General's rigid refusal to allow the company to place any wires underground, is the knowledge that at Liverpool the very opposite is the case. It is under rather melancholy circumstances, however, that I have to refer to this matter. For some two years the National Telephone Company has been converting its Liverpool network from overhead to "underfoot;" but a heavy fall of snow early in the month settling on those wires that still remain outside caused them to snap. The falling wires, coming into contact with the trolley wires of the extensive municipal tramway system there, became charged with the 500 volts traction pressure and mixing themselves up with the passers-by resulted in two deaths and numerous injuries. A big fuss has naturally been occasioned and the blame seems to have been laid at the door of the trolley system of traction, which is quite erroneous. However, I understand that the tramway authorities are considering the advisability of installing some form of guard wire as is the case at Glasgow.

In the light of all this, it has surprised many engineers to find that the borough of Tunbridge Wells, a southern town of some importance, which, under a Post Office license, is being equipped with a municipally controlled telephone service, should have followed the old-fashioned policy and put up overhead wires. The first fall of snow succeeded in bringing some of them down, and the ratepayers are now asking why their money should be wasted in this manner.

While still on the question of telephony, attention may be directed to the accounts of the National Telephone Company for the half-year ended December 31, last. The General Post Office authorities have organized a vigorous competition with the monopoly of the company, and themselves are at present laying wires underground in London for a municipal telephone service, and in addition are granting licences to numerous local bodies to lay down similar services. Naturally, all these schemes, being only in the "in progress" stage, have had no effect upon the returns of the company for the period stated. The half-yearly meeting of the company was held on February 21, and, in view of the inevitable effect of all this competition, the question for the company to solve was, in the words of the chairman: "Are we to cave in or to fight on?" The company's license, held from the Post Office, expires in 1911, while it is open for the General Post Office to take over the concern by arbitration in 1904. Under these circumstances it is praiseworthy on the part of the shareholders to have decided on developing the business as much as possible until 1904, with the object, of course, of forcing the General Post Office

to pay a correspondingly increased price for the undertaking should they decide on the arbitration course. The praiseworthiness of the action arises from the fact that there is more risk in this than is apparent.

A preliminary announcement has just been made that the Institution of Electrical Engineers will visit Germany early this Summer. The proposal is that a start should be made from London on Saturday, June 22, reaching Berlin *via* Hanover. The visit to Berlin will terminate on Thursday, June 27, but for the convenience of members it has been arranged that they may extend their stay and journey on to Dresden, Nuremburg, Frankfort, Cologne and so back to London. Invitations for the present trip were received during the visit to Switzerland, two years ago, from Messrs. Siemens & Halske and the Allgemeine Elektricitäls Gesellschaft.

After some 16 months comes some information as to the use of the X-rays during the South African War. Lieutenant Bruce, of the Royal Artillery Military Corps, has been relating to the Rœntgen Society his experiences during the siege of Ladysmith. In the last Soudan campaign, Lieutenant Colonel Battersby utilized a specially fitted up bicycle arrangement for working his dynamo and so charging his cells. Lieutenant Bruce, however, did not like this idea and went to Ladysmith from Cairo with absolutely no means of operating his dynamo, and his difficulties were accentuated by reason of the fact that no public supply existed at Ladysmith. He succeeded, however, in belting his machine to the shaft of a local flour mill. Considering that this was the first time this sort of thing had been carried out under actual fire, no mean success has been achieved. The negatives obtained of the various injuries were remarkable considering the difficulties under which they were taken. Probably the most pressing need of the X-ray operator is a good portable means of driving the source of current. Lieutenant Bruce proposes a modification of the ordinary tricycle "petrol" motor and the idea is certainly a good one. Paraffin oil would probably be obtainable anywhere and a can of it should last a long time. If this could be managed it would seem that the batteries could be almost done away with, as the coil might be worked direct from the dynamo.

Traction matters have been very much to the front in London during the month. Admirers of the Central London Electric Railway, which is only six months old, have been afforded an opportunity of forming comparisons, on the financial side, between this line and the old established underground steam railway, by reason of the publication of both sets of accounts for the past half-year. The interest in the Central London Railway across the Atlantic should lie in the knowledge that the whole concern is American. The line had, to December 31, last, been running exactly five months, during which no less than 14,916,922 passengers were carried to and fro over the six miles of track. The revenue from passenger fares was £118,008 2s. 8d., while the total receipts amounted to £119,899 18s. 0d. The total expenditure reached £70,433 19s. 7d., leaving a profit of £49,455 18s. 5d., and, after providing for debenture interest, £39,152 8s. 4d. was available for dividends, which was distributed as follows:

Ordinary shares, 2½ per cent..	£24,622 10 0
Preferred half shares, 4 per cent	8,802 0 0
Deferred half shares, 1 per cent	2,200 10 0
	£35,625 0 0

A sum of £3,527 8s. 4d. is therefore carried forward. The fare, I may mention, is a uniform one of 2d. For practically a new venture, so far as London is concerned, it must be conceded that these figures are entirely satisfactory.

In contradistinction to the above, some reference to the results of the underground "circle" line in London for the same period should prove instructive. When the Central London Railway was first thought of, it was admitted on all hands that the inner circle line would suffer mostly, and so it has turned out. At its meeting the other day it was learned that no less a sum than £18,000 was lost during the time the Central London has been running. This amount is accounted for in that the following number of passengers less were carried than in the preceding half-year: First class, 101,000; second class, 272,000; third class, 964,000, making a total of 1,337,000 less passengers carried, obviously due to the competition of the Central London Railway. The directors of the Metropolitan District (circle) line have power to convert to electric traction, and these figures are likely to hurry the matter forward. But, owing to the fact that both up and down tracks are laid in one tunnel—as well as other purely local considerations—much care and thought are being bestowed upon the question of what system shall be adopted. Several firms have submitted schemes, and although it is a fact that nothing at all definite has been decided upon, the utilization of Messrs. Ganz extra high-tension system is said to be looked upon with no unfavorable eye. The Westinghouse company and Messrs. Dick, Kerr & Company have also submitted proposals, however, and at present the matter is certainly in a state of quiescence.

Another traction matter which is troubling London not a little just at present is the question of the sanction of the Board of Trade to the London United Tramways Company. For the best part of a year, now, this company has had a fairly extensive system of trolley tramways all ready for the cars to commence running, but are prevented from doing this owing to the Board of Trade not yet being convinced that the perfectly insulated return employed is practically an ideal one. The reason for all this is the opposition of the authorities of the Kew magnetic observatory, who, in spite of the elaborate tests and arrangements made by the company to prevent any interference with the magnetic records, persist in pursuing a dog-in-the-manger policy, for, although trial cars have been run over the lines for some time now, no definite official statement as to whether there really has been disturbance or not has yet been made. Meanwhile, we have the spectacle of thousands of pounds worth of electric plant standing absolutely idle, and the only satisfaction the public are vouchsafed is that the lines will be worked as soon as the Board of Trade sanction is obtained. This, however, seems as far off now as it was 12 months ago.

Although traditionally slow, the London County Council is surely pushing forward its idea of a conduit system for the tramways in its area. Briefly, the history of this move is as follows: Some two years or more ago Professor A. B. W. Kennedy was retained as the council's consulting electrical engineer and at once visited the United States to mature his plans and advise the council upon the best system of mechanical traction for their present horse lines. After the usual delay, his report was issued and a certain amount of surprise was manifest when Professor Kennedy boldly championed the conduit system. Since the publication of this report, the matter seemed to have sank into oblivion until, as a consequence of the Tramways Exhibition in London last year, it was announced that the Westinghouse company's exhibit, consisting of a complete equipment of its underground conduit system, has been bought *en bloc* by the London County Council, and that trials were to be made at its

depot where the exhibit was installed. That was some six months ago and it was only last week that the next step was taken in the fact that the various London borough councils, and, of course, the press, were invited to a demonstration of the system which has now been finally settled upon and which has been submitted to the Board of Trade for approval. Naturally, every one expected to see the Westinghouse conduit, and no little surprise was apparent when it was discovered that the arrangements put down were entirely an idea of Professor Kennedy's. By the quantity of printed matter issued by the Westinghouse company, it would seem that a certain amount of *pique* is the result.

It is proposed to supply a pressure of 500 volts continuous, and to employ double-deck cars on bogies with a seating capacity of from 64 to 70. The average speed in the busy thoroughfares is to be 10 miles per hour. The conductors are of soft steel T-iron carried on insulators 15 feet apart. An interesting feature about the latter is that they form the support of the conductor which is practically hung from them by a curved piece of gun metal. The cast-iron yokes are at intervals of five feet and the depth to the base of the yoke is two feet one and one-half inches. The conduit tube is of concrete. The technical press and others do not view the design of Professor Kennedy's altogether with favor, but a man of his reputation is probably able to look after himself and it will be a surprising thing if, when the conduit is actually working, any material defect shows up.

A. W.

London, February 20.

The New York & New Jersey Telephone Company's Annual Report.

The annual meeting of the New York & New Jersey Telephone Company was held on March 1, 1901. The eighteenth annual report was submitted to the stockholders by President Cutler, as follows:

Your directors respectfully submit the following report of the result of the year's operations of the company, and of its financial condition on December 31, 1900:

TREASURER'S STATEMENT.

OPERATION.

EARNINGS.

Exchange service	$1,372,916.29	
Pay stations	356,560.11	
Tolls	965,341.18	
Private lines and leased instruments	22,275.33	
Real estate	83,938.76	
Other sources	26,449.40	
		$2,827,481.07

EXPENSES.

General expense	$504,613.20	
Operating expense	460,839.58	
Maintenance	727,508.05	
Reconstruction	120,140.58	
Royalties	147,416.94	
Real estate expense	58,084.89	
		$2,018,603.24

Earnings over expense of operation		$808,877.83

FIXED CHARGES AND TAXES.

Interest	$72,271.73	
Taxes	102,459.39	
		$174,731.12
Net earnings applicable to dividends		$634,146.71
Dividends		490,650.00
Surplus earnings, 1900		$143,496.71
Surplus, January 1, 1900		1,933,112.85
Surplus, December 31, 1900		$2,076,609.56

BALANCE SHEET.

DECEMBER 31, 1900.

ASSETS.

Plant	$8,280,472.10	
Equipment	1,111,010.72	
Real estate	1,007,360.41	
Supplies	547,458.63	
Accounts receivable	725,844.48	
Treasury stock	165,600.00	
Stock and bonds	250,517.80	
Cash	228,398.04	
		$12,316,722.18

LIABILITIES.

Capital stock	$7,665,600.00	
General mortgage bonds	1,339,000.00	
Real estate mortgages	111,500.00	
Vouchers and accounts payable	376,197.47	
Bills payable	530,000.00	
Reserve for accrued interest, etc.	30,315.15	
Reserved for dividends declared December, 1900, payable January, 1901	187,500.00	
Surplus, December 31, 1900	2,076,609.56	
		$12,316,722.18

COMPARISON.

	1900.	1899.	Changes.
Gross earnings	$2,827,481.07	$2,381,368.95	$446,113.12 inc.
Oper. expenses	2,018,603.24	1,618,191.84	400,411.40 inc.
Earnings over expenses	$808,877.83	$763,177.11	$45,707.72 inc.
Fixed charges, taxes and dividends	665,381.12	540,406.87	124,974.25 inc.
	$143,496.71	$222,770 24	$79,273.53 dec.

The expenditures during 1900 for construction purposes have been as follows:

Aerial exchange and private lines	$349,939.00
Underground conduits and cables	644,695.00
Trunk lines	153,317.00
Equipment	222,257.00
Real estate	55,034.00
Total	$1,425,242.00

The number of stations connected with the company's system on December 31, 1900, was 35,176, a gain during the year of 7,103. Previous year's gain was 6,008.

The earnings from tolls for intercommunication between exchange centres were $965,341.18, a gain of $155,634.77 over earnings from same source during the previous year.

Your directors see no reason to doubt that the increasing demand for telephone service in our territory which has existed in past years is likely to continue for several years to come. To supply this demand will require a constant enlargement of plant.

The last issue of new stock nearly exhausted the authorized capital of the company, and your directors deemed it wise to suggest an increase of capital before making a further issue to meet future requirements.

A special meeting of stockholders has been called to meet directly following the regular annual meeting of the company to consider this suggestion. If it shall be your pleasure to vote the proposed increase, it is the intention of your board of directors to offer the new stock from time to time in such amounts as the best interests of the company may seem to dictate.

The replacement of the old central office system of operation by the improved system, which was commenced during 1899, has been further progressed during the past year. At this time the improved apparatus is in successful operation at our five most important exchanges—Main, Williamsburgh and Bedford, in Brooklyn, and Newark and Paterson, in New Jersey.

The introduction of the new system at some of the exchanges next in importance to those above named is under consideration.

These changes necessitate large charges against our earnings account to cover reconstruction costs and a proper allowance for depreciation in value of the replaced apparatus. The charges against reconstruction and maintenance account (taken from the earnings) for the year 1900 amounted to $847,648.63.

No new competing systems have been inaugurated in our territory since the date of our last annual report, and those then in operation do not appear to be very prosperous or to have extended their operations in any considerable degree.

We take pleasure in expressing our appreciation of the fidelity and ability with which the heads of the various departments, and the employés generally, have performed their various duties. Their zealous and harmonious service in the company's interest has contributed very largely to its success.

For the Board of Directors,
CHARLES F. CUTLER,
President.

New York, February 20.

It was voted to increase the capital stock of the company from $8,000,000 to $15,000,000, the increased capital to be issued at the discretion of the board of directors. The following-named gentlemen were reelected members of the board: Charles F. Cutler, New York, N. Y.; Alexander Cameron, Brooklyn, N. Y.; Joseph P. Davis, New York, N. Y.; Chas. A. Nichols, Springfield, Mass.; Hugh Kinnard, Newark, N. J.; William D. Sargent, Brooklyn, N. Y.; David B. Powell, Brooklyn, N. Y.; George H. Prentiss, New York, N. Y.; Felix Campbell, Brooklyn, N. Y.; Edward J. Hall, New York, N. Y.; Henry Sanger Snow, Brooklyn, N. Y., and Zenas Crane, Dalton, Mass.

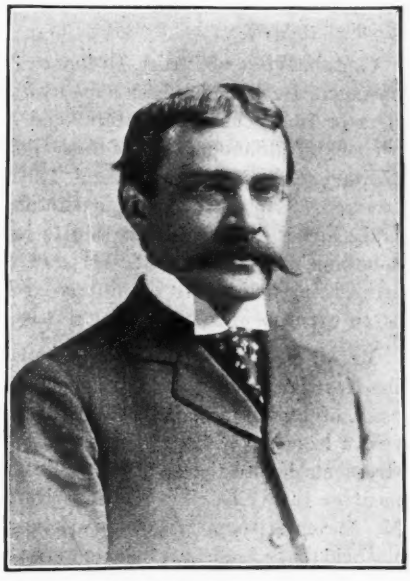
Drs. Duncan and Hutchinson Appointed Consulting Electrical Engineers to the Rapid Transit Commission.

Dr. Louis Duncan and Dr. Cary T. Hutchinson have been appointed consulting electrical engineers to assist Chief Engineer William Barclay Parsons, of the New York City Rapid Transit Commission. Messrs. Duncan and Hutchinson will have charge of all the electrical work to be done in the tunnel now building in New York.

Dr. Louis Duncan is a graduate of the United States Naval Academy, of the class of '80. Shortly after graduation he was called to Johns Hopkins University to establish and take charge of the department of electrical engineering, of which he was the head practically during the entire continuation of this course there, that is, until 1898. In 1891, he, with Messrs. Sprague and Hutchinson, formed the firm of Sprague, Duncan & Hutchinson. Since the dissolution of this firm he has been practicing electrical engineering alone. He was in charge of much of the work on the Baltimore & Ohio tunnel plant, the systems of the Baltimore Traction Company, all of the underground conduit work in Washington; was chief engineer of the Third Avenue Railroad Company, of New York, and many other similar enterprises. He has made a specialty of investigations and reports on construction and operation of electrical projects for capitalists. Recently he was chief engineer of the independent telephone companies in Baltimore and Pittsburgh, and now in Philadelphia. Dr. Duncan was for two terms president of the American Institute of Electrical Engineers, after having previously served as vice-president.

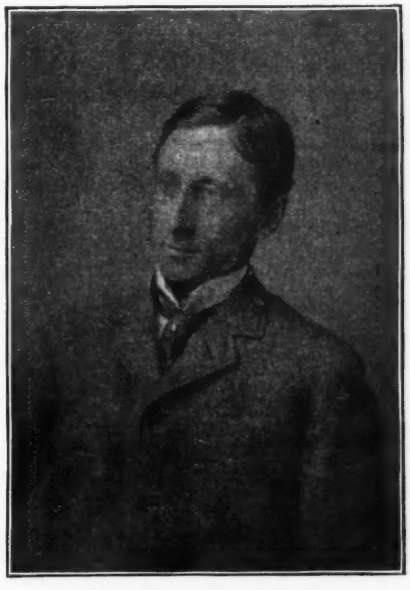
Dr. Cary T. Hutchinson was graduated from Washington University, St. Louis, in 1886, and from Johns Hopkins University in 1889, with the degree of Ph.D. He has been connected with the Sprague Electric Railway and Motor Company, and the Edison General Electric Company at Schenectady, and was a member of the firm of Sprague, Duncan & Hutchinson. Since the dissolution of this firm in 1893, he has practiced as a consulting electrical engineer. He was actively engaged in all the work that Sprague, Duncan & Hutchinson undertook, and has since had charge of the engineering work of the Lachine Rapids Power Company, Montreal; Bakersfield Power Company; Hudson River Water Power Company, and others. He is a vice-president of the American Institute of Electrical Engineers.

Drs. Duncan and Hutchinson have been since 1891 associated in much of the important electrical engineering work that has been done. They, in conjunction with Mr. Sprague, designed and built the first large electric locomotive, in 1891, for the



Dr. Louis Duncan.

North American Company. They were the engineers of the Baltimore & Ohio tunnel work, completed in 1894, and which has been operating so much to the satisfaction of the Baltimore & Ohio Railroad Company that this company has now



Dr. Cary T. Hutchinson.

asked them to investigate the proposition of conducting their entire train service over the Allegheny Mountains by electricity. This will be one of the most extensive electric traction problems ever undertaken. Dr. Duncan is a well-known authority on all matters pertaining to electric traction, transmission and storage battery matters, and has been associated with a number of enterprises of this character.

Wall Street and the Electrical Stock Market.

On the New York Stock Exchange, General Electric closed the week at 215 bid and 216 asked, showing a gain of 5 points. Metropolitan Street Railway, of New York, closed at 165 bid and 165⅛ asked, indicating a gain of 4½ points for the week. Brooklyn Rapid Transit closed at 78⅝ bid and 78¾ asked, indicating a gain of 4⅛ points. Third Avenue Railroad closed at 121½ bid and 122½ asked, showing a gain of 2½ points. Manhattan Railway, of New York, closed at 119⅛ bid and 119¼ asked, showing a gain of 1⅝ points for the week.

On the Boston exchange, American Telephone and Telegraph closed the week at 160 bid and 161 asked, showing a gain of 2 points. Erie Telephone closed at 52½ asked and no bid price quoted, showing a gain of 2½ points in the asked price over last week. New England Telephone closed at 135 bid and no asked price quoted, indicating no change for the week.

On the Philadelphia exchange, Electric Storage Battery was not quoted. The net earnings of $1,317,865 reported by the Electric Storage Battery Company for the year 1900 are over 7½ per cent, or nearly $17,000,000 capital outstanding, of which amount $5,000,000 is preferred. It is stated that $400,000 above the 5 per cent dividends on each class of stock carried to the credit of the surplus account is being used as working capital in the business. In 1899, the profits of the company included profits from electric vehicle investments, while the profits for 1900 are said to represent entirely the regular receipts from the storage battery business. The company has paid off a $400,000 mortgage, and $300,000 of accumulated dividends in the last two years. Electric Company of America closed at 8¾ bid and 8¾ asked, showing no change for the week in the bid price. Union Traction closed at 32½ bid and 32⅝ asked, showing a loss for the week of 1⅜ points.

On the curb, or outside market, in New York, Electric Vehicle closed the week at 14 bid and 15 asked, indicating a loss of 1 point. Electric boat closed at 24 bid and 26 asked, showing a loss of 2½ points. Consolidated Equipment closed at 11¼ bid and 11½ asked, showing a gain of ¾ point for the week.

Wall street, March 9.

The City & Suburban Telegraph Association (Bell Telephone Company, of Cincinnati) shows earnings as follows: Gross earnings, 1900, $599,064; expenses, $377,265; net, $221,798. The company is capitalized for $3,465,000.

PERSONAL.

Mr. William B. McCurdy and Miss Estelle M. Dwight were married at the home of the bride in Chicago on March 4. Mr. McCurdy is manager of the New York branch of the American Electric Fuse Company, of Chicago. Mr. and Mrs. McCurdy will make their home in Brooklyn after April 1. Mr. McCurdy is one of the younger generation who has rapidly won a place for himself in the electrical industry, and the ELECTRICAL REVIEW reflects the congratulations of his many friends.

Mr. Gardiner C. Sims, the well-known engine builder, after two years' service with the United States Army, has decided to reenter the steam engine field, and will hereafter be general manager of the William A. Harris Steam Engine Company, of Providence, R. I. Mr. Sims is one of the pioneer builders of engines for the electric lighting field, and will receive a very hearty welcome from a vast number of old-time friends and patrons.

Mr. E. B. Baker, general manager of the Southern New England Telephone Company, was a New York visitor last week. Mr. Baker reports that the telephone business of his company is on the order of expansion. Many new subscribers are being provided with service. A plan of public telephone booths, located on street corners, is soon to go into effect at New Haven, and is an entirely new departure in the telephone field.

President McKinley, on March 9, sent to the Senate the nomination of Professor Samuel W. Stratton, of Chicago, to be director of the National Bureau of Standards, recently created by Congress. Professor Stratton is at present director of the Bureau of Weights and Measures, and was formerly professor of physics at the University of Chicago. He served as a volunteer in the Spanish-American War as a lieutenant in the navy.

Mr. J. P. Ord, who, as announced in the ELECTRICAL REVIEW last week, has resigned the office of second vice-president of the General Electric Company, has again joined the firm of J. P. Morgan & Company, with which he was formerly connected. Mr. Ord, it is reported, will have a prominent place in the business management of the new United States Steel Corporation.

Mr. F. A. Lundquist, formerly of the National Automatic Telephone Company, and the inventor of a number of devices relating to this branch of telephone work, has accepted the position of manager of the Globe Automatic Telephone Company, of Chicago. Mr. Lundquist has a wide acquaintance in the telephone manufacturing field, having previously been connected with the Strowger Automatic Telephone Company.

Captain William Crozier, Ordnance Department, U. S. A., has been appointed instructor in the chair of natural and experimental philosophy at the West Point Military Academy, *vice* General Michie, deceased. Captain Crozier's appointment ranks him a colonel. He is said to have done much for the scientific corps of the army, being well known in military circles as an experimenter and inventor.

Mr. J. Franklin Stevens, president of the Keystone Electrical Instrument Company, of Philadelphia, on March 8, delivered a lecture on electrical measuring instruments before the engineering department of the University of Pennsylvania. Mr. Stevens's lecture was of the most practical character, and the students were permitted to dissect the instruments shown and to ask whatever questions they saw fit.

Mr. William Carpenter Woodward and Mr. M. Loud, leading electric lighting apostles of Providence, R. I., were New York visitors last week. These gentlemen are elated over the fact that the output of their company, the Narragansett Electric Lighting Company, is next to the first in all New England, following immediately after the Edison Illuminating Company of Boston.

Professor Peter Guthrie Tait has resigned the chair of natural philosophy at Edinburgh University, on account of ill health. He has occupied the chair for 40 years, and for the last 10 years has devoted his time principally to the investigation of mathematics as applied to physics. For many years Professor Tait was closely associated with Lord Kelvin in his work.

Mr. J. W. Smith, until recently superintendent of the Fairmount Park Transportation Company, of Philadelphia, has been appointed general manager of the San Juan & Rio Piedras Railroad Company, of San Juan, Puerto Rico.

Signor Guglielmo Marconi arrived in New York city on Thursday from London. He is here on business connected with his system of wireless telegraphy and will spend about a month in the United States.

Mr. S. S. Dickenson, superintendent of the Commercial Cable at Canso, Nova Scotia, has been decorated by the King of Portugal for services in connection with the landing of the new German and Commercial cables at the Azores.

The resignation of Lieutenant A. J. Wadhams, U. S. N., has been accepted by the President to take effect on May 5. Lieutenant Wadhams will engage in the electrical business in New York.

Mr. E. W. Sawtelle, who has represented the Westinghouse Electric and Manufacturing Company in Europe for about two years, recently returned to New York city from England.

Mr. W. J. Clark, foreign manager for the General Electric Company, after a visit of several weeks in New York city, sailed for London last Wednesday.

Mr. Thomas E. Mitten, of Milwaukee, Wis., has been appointed superintendent of the International Traction Company, of Buffalo, N. Y.

Mr. Paulding F. Sellers has been appointed electrical engineer for the Buffalo General Electric Company, of Buffalo, N. Y.

Mr. E. J. Evans, superintendent of telegraph for the New York, Chicago & St. Louis Railroad, has resigned.

Storm Damages Wires in the West.

A severe hail, sleet and snow storm, which struck Chicago on March 11, did a great deal of damage to the overhead telephone and telegraph wires in that city and vicinity. The poles were blown down and wires laden with ice were broken. On the previous day communication between Chicago and surrounding points was practically cut off, but a repair gang sent out during the day succeeded in reestablishing many connections except on lines near the west shore of the lake. Press reports state that 300 poles and many miles of wire were blown down in the city alone. On the date mentioned the only long-distance line working out of Chicago was that to St Louis. One man and two horses were killed by live wires. The losses to the Western Union and Postal telegraph companies are estimated at $50,000 and to the Chicago Telephone Company $20,000. The fire and police wires of the city of Chicago are estimated to have been damaged to the extent of $10,000. The storm put out of business more than 10,000 telephones in Detroit on March 10, according to newspaper reports. The Michigan Bell Telephone Company estimates its total loss in the state at $20,000. The electric railway service of Detroit was greatly impaired. Reports from other western states indicate that the storm was an unusually severe and disastrous one.

Projected Electric Railway in Barcelona.

United States Consul-General Lay writes as follows from Barcelona, Spain: "I am informed that Messrs. Corady y Cia. have obtained from the municipality of Barcelona a concession to build an electric railway eight kilometres (4.9 miles) in length around the mountain of Montjuich. I understand the rails have been contracted for in Belgium. The line is not to be constructed on the trolley system; the cars are to be drawn by electric engines. The chief engineer is the Marquis Armand de Bourbon Neilson, and his address is care of Messrs. Corady y Cia., Boria, 1 plaza Angel, Barcelona. Our electrical supply and equipment companies should correspond with him. He states that engines, accumulators and cars are required."

American Electric Fuse Company.

On account of heavy increases in its business the American Electric Fuse Company, of Chicago, New York and San Francisco, has more than doubled its working capacity, installing new machinery throughout its factories for turning out its well-known specialties. It is expected by the company in the near future that various important improvements upon its standard lines, fuses, lightning arresters, etc., will be placed upon the market. The eastern office of the company is located at 116 Nassau street, New York, being in charge of Mr. W. B. McCurdy. With its enlarged facilities and increased capacity the company expects in the future to give even better service than it maintains at the present time.

General Electric Company Enjoins Lorain Steel Company.

The General Electric Company, on March 11, was granted an injunction in the United States Circuit Court at New York, restraining the Lorain Steel Company, of Cleveland, and Major H. C. Evans, its New York agent, from making, selling, or using the Edgar combination trolley frame and wheel.

A New Wire Plant.

The National Conduit and Cable Company's new wire plant at Hastings-on-Hudson, N. Y., is finished, and manufacturing has been begun in it. It cost more than $400,000, and will have a yearly output of 100,000,000 pounds, this being considered the largest copper wire plant in the world.

Thomaston, Ga., will shortly issue $10,000 for a municipal electric light plant.

Death of Captain George N. Stone.

Captain George N. Stone, president of the City and Suburban Telegraph Association, the local Bell telephone company of Cincinnati, died at his home in that city, on March 8, of general collapse, resulting from a complication of diseases and following an operation for appendicitis. He was born in Stark, N. H., and was 60 years old. He was a large stockholder in the local telephone, street railway and gas companies. He was a lieutenant and captain in the Seventh Rhode Island Regiment during the Civil War and finally served on General Schofield's staff. Captain Stone was one of the most progressive citizens of Cincinnati,

CAPTAIN GEORGE NELSON STONE.

and had done much for the business and transportation interests of the community. He was a lover of fine horses and was the discoverer of the celebrated trotting mare Maud S., which was named after one of his daughters and afterwards sold to William H. Vanderbilt for $21,000. Captain Stone had a large acquaintance among the telephone men of the country and his death will be regretted by many.

Death of Senator Magee.

Senator Christopher Lyman Magee, the well-known republican leader, died at his temporary home in Harrisburg, Pa., on March 8, after a painful illness. He had suffered from a cancerous disease for about two years, but lately his physicians had expressed hope for his recovery. He was born in Pittsburgh, Pa., on April 14, 1848, and was engaged in mercantile pursuits in his earlier business career. At the time of his death his fortune was estimated at $3,000,000. He was a political leader in western Pennsylvania for more than 25 years. Mr. Magee laid the foundation for his fortune in the development of natural gas and rapidly increased his wealth by investments in Pittsburgh street railroads. At the time of his death he was the president of the Consolidated Traction Company, of Pittsburgh, and was a director in many financial corporations. His life was insured for $1,000,000 in favor of his wife.

OBITUARY.

Gilbert Wilkes, a well-known consulting electrical engineer, of Denver, Colo., died at his home in that city on March 11. Mr. Wilkes was born in Utah, and was a graduate of the United States Naval Academy at Annapolis in the class of '81. After 11 years spent in the service he resigned to enter electrical engineering work. He had been connected with a number of important projects, and was well known to the engineering fraternity, especially in the West. During the war with Spain he served on the Yosemite. He was a member of the American Institute of Electrical Engineers. He leaves a wife, who is a daughter of Charles Denby, former minister to China.

Francis O. Matthiessen, president of the Weston Electrical Instrument Company, of Newark, N. J., and for several years a director of the American Sugar Refining Company, died recently in Paris. He retired from business about a year ago and had since been traveling for his health. He was born in the Duchy of Holstein, in 1833, and came to the United States in 1859. Mr. Matthiessen was a director of the Goubert Manufacturing Company, the New Jersey Street Railway Company, the Glucose Sugar Refining Company, of Chicago, and was a member of the South Side Sportsmen's Club, the New York Club, the Metropolitan Museum of Art, the Museum of Natural History, and of the New York Chamber of Commerce.

The Institute Conversazione.

The conversazione of the American Institute of Electrical Engineers, to be held at Columbia University in New York city, on April 12, promises to be unusually interesting, both from a social and scientific standpoint. A number of novel and interesting exhibits and demonstrations are promised. Lecture rooms have been secured for the exhibition and entertainments, and the elevators will be in service. The council and committee on application will issue gratis to each member a ticket for himself and lady, and a limited number of extra tickets at $1 each. Invitations will be extended to a select list of guests.

Telephone and Telegraph

Negotiations are being conducted in Hanover, Pa., for an independent telephone company, which, if successfully chartered, will compete with the Pennsylvania system.

The capital of the Hudson River Telephone Company, which operates in Albany, N. Y., and along the Hudson and Mohawk valleys, has been increased from $3,000,000 to $4,000,000.

A municipal telephone system is contemplated by the city authorities of Baltimore, Md., who think that the cost of the city hall telephone service will be greatly reduced by the inauguration of such a system.

The new building of the People's Telephone and Telegraph Company at Knoxville, Tenn., is soon to be built at a heavy expense, and the company will soon issue $40,000 or $50,000 worth of bonds to cover the cost.

The telephone cable which is to connect Lake Providence, La., with the Cumberland long-distance system on the other side of the river, was successfully laid recently and the line has been brought to the central exchange.

Contracts have been closed in Wabash, Ind., by the United Telephone Company for the erection of a toll line from Huntington to Wabash, and from there to Rochester. The total length of the new construction will be about 50 miles.

A franchise has been applied for by the People's Independent Telephone Company, which desires to operate an exchange in Warsaw, N. Y. The company names $16 as its rate for residences and $30 for business places, the service to be on single metallic circuits.

The local exchange of the Bell Telephone Company, at Batavia, N. Y., is to be entirely reconstructed in the near future. The wires are to be taken down and replaced with cables, each containing 800 wires and 400 pairs. The cost of the reconstruction will be about $15,000.

A new telephone company has recently been incorporated in Frederick County, Md., with its principal office in Wolfsville. The company will build a telephone line from Myersville to Wolfsville, *via* Ellerton and Middlepoint. The officers are Dr. A. J. Smith, president, A. E. Hoover, secretary, and W. E. Hankman, treasurer. The capital of the company was not stated in the press reports.

Important improvements are to be installed in the near future by the Delaware & Atlantic Telephone Company, both in its local and long-distance service in Chester, Westchester and Coatesville, Pa. The company now owns 27 direct trunk lines running to important centres, and from there connecting with other lines to points throughout the country. Mr. H. P. Ettinger is the newly appointed manager.

The New York & New Jersey Telephone Company, which operates throughout Long Island and New Jersey, has issued its annual report for the year ending December 31, 1900. The comparison:

	1900.	1899.	1898.	1897.
Gross earnings.....	$2,827,481	$2,381,368	$2,058,477	$1,790,287
Operating expenses...	2,018,603	1,618,191	1,433,476	1,236,819
Net.....	808,877	763,177	625,000	553,467
Charges	174,781	141,556	127,683	109,305
Balance.....	634,146	621,620	497,313	444.162
Dividends ...	490,650	398,850	316,622	272,420
Surplus ..	143,496	222,770	181,695	161,741

The city engineer of Baltimore, Md., recently held up the application of the Chesapeake & Potomac Telephone Company for a permit to construct a subway connection between German and Grant streets and the Carrollton Hotel. The court decided that the company may not maintain overhead wires on the streets where it has conduit lines, and the city solicitor has been authorized to make a thorough investigation of the company's status.

The Atlantic Telephone Company, which was recently incorporated in Albany, N. Y., with a capital of $5,000,000, is said to intend competing for business in the Harlem district of New York city by offering to supply householders and business men with telephone service at the rate of five cents per message. The company is believed to have secured control of the New York Eastern Telephone Company, including all its subway franchises.

Southern advices state that the East Tennessee Telephone Company, which operates 40 exchanges in Tennessee under the Bell franchises, has passed into the hands of the Cumberland Telephone Company. Forty per cent of the stock of this company is owned by the American Telephone and Telegraph Company, and 11 per cent by the Western Electric Company. The Tennessee company's capital stock is $300,000, and it has bonds issued to the amount of $200,000.

A fight is on in Hartford City, Ind., between the Indiana Telephone Company and the Central Union Company. The two companies are keen rivals, and there is considerable feeling manifested, according to the press reports, by the members of both concerns. The same conditions obtain in Crawfordsville, Ind., and the Central Union is said to have cut the independent rates in two, soliciting subscribers on the proposition that it will soon have as many subscribers as the home telephone company.

Persistent rumors are afloat in Canada confirming the report published some days ago regarding the acquisition by the Dominion Government of the telegraph systems throughout the provinces, notably the lines of the Great Northwestern Telegraph, which company is the Canadian connection of the Western Union. Mr. H. P. Dwight, president of the company, and the Dominion Minister of Railways are said to have been in secret conference for several days regarding the matter, but neither gentleman would talk of the plan.

An agreement has been effected by the representatives of the independent telephone companies of Pennsylvania, Maryland, Virginia and West Virginia, whereby all the companies will be merged with a capital of $2,000,000. The headquarters of the concern will be in York, Pa. The officers state that arrangements will be made whereby long-distance service to Philadelphia and New York will be secured over the wires of the Keystone Company, of Philadelphia. It is hoped ultimately that the new corporation will be able to unite with the independent telephone companies of the western states.

Mr. Charles J. Glidden, of the Erie Telephone Company, returned last week from a tour of inspection of the Erie's properties in the Southwest and at Cleveland. Mr. Glidden is reported in the Boston *News Bureau* as stating that the extensions by the telephone interests in the Southwest have been practically completed and that he is looking forward to a satisfactory and still larger increase during 1901. This company is now operating 15,000 telephone subscribers in the city of Cleveland, Ohio, and the ninth exchange building, which will be completed by July 1, will increase the capacity so it can supply 25,000 subscribers with service. In reply to Mr. John I. Sabin, of the Pacific coast, Mr. Glidden says:

"The Erie has not deserted President Sabin's glorious flag of expansion but only stopped a moment to take breath. Erie will continue in the rank of progressive telephone companies supplying every public demand and preventing opposition as heretofore from invading the territory to the detriment of the system. With our magnificently established foundation plants new subscribers can be added and extra long-distance circuits constructed at a much less ratio cost than heretofore."

Book Reviews

"Electric Lighting." Volume 2. Distributing System and Lamps. By Francis B. Crocker. D. Van Nostrand Company, New York, 1901. Cloth. 6 by 9 inches. 501 pages. 391 illustrations. Supplied by the ELECTRICAL REVIEW at $5.00.

In the second volume of his work on the subject of electric lighting, Professor Crocker gives a treatise on that part of the electric lighting system outside of the generating plants, the plants themselves having been treated in the first volume. Properties of conductors and the various systems of electrical distribution, both for direct currents and alternating currents, are very thoroughly discussed in the first half of the book. Arc lamps, incandescent lamps, interior wiring and electric meters are given much attention and in an appendix is quoted the National electric code and the report of the committee on standardization of the American Institute. Both volumes are intended as text-books for engineering schools and as handbooks for practicing engineers and for that reason abstruse detail and technical matter has been for the most part omitted. Professor Crocker is to be congratulated upon this admirable work. A plain, readable book that discusses this subject so that it may be understood fully by the men who most need to learn by it—that is, electrical artisans and mechanics as well as superintendents and contractors— is of real and genuine value. It is impossible in the short space at disposal here to give any detailed description of this book, but it gathers together into one compact and satisfactory shape a vast amount of information about electric circuits. It seems likely that it will be widely used as an electrical text-book. The typographical appearance of the work is exceedingly neat and attractive.

"The Lead Storage Battery. Its History, Theory, Construction and Use." By Desmond Fitz-Gerald. Biggs & Company, London, 1900. Cloth. 5 by 7 inches. 383 pages. Many illustrations. Supplied by the ELECTRICAL REVIEW at $3.00.

The subject matter of this book appeared as a serial in one of our British contemporaries. It is not intended for beginners but rather for those who have had some experience in the use or construction of the ordinary types of storage battery. The arrangement of the book is excellent and it seems to cover its subject with great fulness, although it is to be regretted that Mr. Fitz-Gerald so often wanders astray from his theme into labyrinths of words not really necessary to the proper exposition of the subject. A considerable discussion of the chemistry of pyroxylene is given for the reason that the author considers that this material will be largely used in the future in accumulator construction. On the whole, the book is one that will at once take its place as an authoritative work upon its subject, and is a distinctly valuable contribution to electrical literature, since it fills a place hitherto vacant. It is a curious fact that the literature of the storage battery has been exceedingly small when compared with the large extension of the employment of accumulators.

"Questions and Answers from the *American Machinist*." Compiled by Frank Richards. American Machinist Press, New York, 1900. Cloth. 5 by 7 inches. 403 pages. Numerous illustrations. Supplied by the ELECTRICAL REVIEW at $1.50.

Many questions have been answered in the columns of the *American Machinist,* and its staff, believing that many of the inquiries received are upon subjects of definite and permanent interest and that the answers, often given after considerable labor and investigation or research, are worthy preserving in a more complete form, have issued this work. The book makes exceedingly interesting reading to the practical man who thinks.

"The Inspector and the Trouble Man." The Electrical Engineering Publishing Company, Chicago. Cloth. 125 pages. 6½ by 10 inches. Many illustrations. Supplied by the ELECTRICAL REVIEW at $1.00.

This is a reprint of a series of conversational articles that appeared in *Telephone Magazine,* and which the publishers have been led to reprint in this form on account of the demand for them from the public. It seems as if the same information might have been just as well imparted without hauling in Bill and John and the rest of the characters that tell each other things through the book.

"Electric Wiring Tables." By W. P. Maycock. Whitaker & Company, London, 1900. Leather. 2¾ by 4 inches. 144 pages and numerous tables. Supplied by the ELECTRICAL REVIEW at $1.00.

This is an excellent little volume which is, of course, somewhat limited on account of its preparation for British workmen and under British rules. It is a real and genuine pocketbook, as it may be conveniently carried in the pocket and will doubtless be found of great use to those engaged in wiring work in Great Britain.

"Moody's Manual of Industrial and Miscellaneous Securities." The O. C. Lewis Company, New York. Cloth. 1,108 pages. 6 by 9 inches. Supplied by the ELECTRICAL REVIEW at $5.00.

The contents of this book may easily be judged from its title. It gives in short, concise fashion the principal facts of record concerning industrial corporations and their securities. To those interested in the financial side of industrial affairs it can not fail to be of considerable value.

"The Universal Electrical Directory (J. A. Berly's) for 1901." London. H. Alabaster, Gatehouse & Company. Cloth. 1,328 pages. 6½ by 10 inches. Supplied by the ELECTRICAL REVIEW at $3.00.

The "Red Book" is so well known, that a review of it is unnecessary. It is a directory of electrical manufacturers and engineers in all the countries of the world, and is a book of great value to those having business dealings with the electrical fraternity at large.

"The A. B. C. of Dynamo Design." By Alfred H. Avery. Dawbarn & Ward, Limited, London. Cloth. 104 pages. 61 illustrations. Supplied by the ELECTRICAL REVIEW at 60 cents.

This is a good, simple, straightforward treatise, but it attempts to do rather too much in too small a compass; nevertheless, it is worth the reading and will be found interesting by those who are attempting to make small dynamos for their own use.

"Practical Lessons in Metal Turning." By Percival Marshall. Dawbarn & Ward, Limited, London, 1900. Cloth. 5 by 7 inches. 166 pages. 193 illustrations. Supplied by the ELECTRICAL REVIEW at $1.00.

This little book is a manual for the use of young engineers and amateur mechanics who wish to obtain some light on metal turning and methods. The book is plainly and simply written and is full of good practical hints and suggestions.

"Model Boiler Making." By E. L. Pearce. Dawbarn & Ward, Limited, London, 1900. Paper. 5 by 7 inches. 88 pages. 35 illustrations. Supplied by the ELECTRICAL REVIEW at 30 cents.

In this little book is shown how to make small boilers such as an amateur might want to construct for operating a small engine, launch or for such other purposes. It is a good practical book, written by a practical man.

"Electricity and the Resurrection, or the Soul and Science." By William Hemstreet. Universal Truth Publishing Company, Chicago, 1900.

It is hard to decide about some books whether it is more remarkable that some one wrote them or that he succeeded in finding a publisher. This is one of the books.

President Shattuck, of the Automobile Club of America, recently appeared before the Assembly Committee on Internal Affairs, at Washington, D. C., with a number of his fellow-members at the hearing of the automobile speed-regulation bill. With Mr. Shattuck and the other gentlemen were several automobile makers who brought machines with them to the Capital City for demonstration purposes in the public streets.

Corporation News

DAVENPORT, IOWA—Franklin Electric Company. $50,000.

WILMINGTON, DEL. — Park Railway Company. $100,000.

LOS ANGELES, CAL.—Rincon Water Power Company. $500,000.

NEW ORLEANS, LA. — New Orleans Power-House Company. $50,000.

PATCHOGUE, L. I.—Baiting Hollow & Roanoke Telephone Company. $5,000.

NEW HAVEN, CT.—William J. Smith Company. $100,000. Paid-up stock, $30,000.

CHICAGO, ILL.—The National X-Ray Company has increased its capital stock from $10,000 to $25,000.

SYCAMORE, ILL.—The De Kalb County Telephone Company has increased its capital stock from $15,000 to $50,000.

WARRENTON, MO.—The Electric Company. $6,000. Incorporators: R. H. Kemper, G. Hillemeyer and others.

RAVENNA, OHIO—The Ravenna Home Telephone Company has increased its capital stock from $10,000 to $200,000.

HOUSTON, TEX.—Shepherd Water Power Company. $25,000. Incorporators: R. Lockhart, D. P. Shepherd and others.

NEW YORK, N. Y.—Standard Automobile Company. $125,000. Incorporators: G. Levy, R. J. Rudd and R. J. Rudd, Jr.

ALBANY, N. Y.—The Hudson River Telephone Company has increased its capital stock from $3,000,000 to $4,000,000.

ROCHESTER, N. Y.—Radiant Incandescent Light Company. $10,000. Directors: E. F. Craggs, L. W. Paul and J. A. Beggy.

INDIANAPOLIS, IND.—Commercial Electric Company. $33,700. Incorporated at Springfield, Ill. Capital in Illinois, $2,500.

CANTON, OHIO—The Canton Light, Heat and Power Company has increased its capital stock from $150,000 to $225,000.

BELMONT, TEX. — Southwestern Telephone Company. $50,000. Incorporators: L. Harrison, S. E. Chapin and T. C. Kegy.

LOS ANGELES, CAL.—San Bernardino Power Company. $200,000. Incorporators: T. A. Ringler, C. N. Howland and others.

GREENCASTLE, IND.—Greencastle, Hamrick & Oakala Telephone Company. $510. Incorporators: J. M. King and J. E. Houck.

NEWARK, N. J.—American Transformer Company. $25,000. Incorporators: E. B. Watkins, W. L. Kimball and A. G. Brown.

BALTIMORE, MD. — Hughes Telephone Company. $100,000. Incorporators: C. J. Hughes, E. L. Ward, J. M. Burrow and others.

LEXINGTON, KY.—Blue Grass Rapid Transit Company. $30,000, with the privilege to increase its capital stock to $1,000,000.

ROCKY FALLS, N. J.—Rocky Falls Power Company. $100,000. Incorporators: Howard Mutchler, C. L. Hemingway and R. A. Montgomery.

CHICAGO, ILL.—Globe Automatic Telephone Company. $25,000. Incorporators: T. A. Lundquist, W. B. Sawyer and J. E. Norling.

NEW HAVEN, CT.—Truck Automobile Company. $2,000,000. Incorporators: T. H. Dickson, J. B. Taylor, G. B. Martin and S. Welsch.

JEFFERSON CITY, MO.—Clear Fork Telephone Company, of Cass County. $25,000. Incorporators: F. D. Nelson, D. J. Miller and others.

DAYTON, OHIO—Miami & Erie Transportation Company. $10,000. Incorporators: D. J. Ryan, M. T. Watts, T. N. Fordyce and others.

GRIGGSVILLE, ILL.—The Farmers and Merchants Union Telephone Company. $2,500. Incorporators: A. N. Orr, A. Zimmerman and J. W. Orr.

BUCYRUS, OHIO—Bucyrus Gas and Electric Light Company. $150,000. Incorporators: F. P. Kailer, J. B. Gormley, J. W. Gwynn and others.

INDIANAPOLIS, IND. — Indianapolis & Lebanon Traction Company. $400,000. Directors: J. S. Holliday, W. Helfenberger, E. T. Baker and others.

PEORIA, ILL.—Bradley Park Light, Heat and Power Company. $100,000. Incorporators: G. A. E. Kohler, W. H. Ballance and G. H. Binckley.

FARGO, N. D.—Light, Heat, Transit and Public Service Company. $100,000. Incorporators: F. R. Green, A. G. Whitney, C. A. Wheeler and others.

DAVILLA, MILAN COUNTY, TEX.—Davilla Telephone and Improvement Company. $10,000. Incorporators: R. P. Kerr, E. H. White and others.

COLUMBUS, OHIO — Columbus, Delaware & Northern Traction Company. $10,000. Incorporators: J. M. Loren, T. N. Baker and others, of Columbus.

KANSAS CITY, MO.—Independent Electric Railway Company. $2,000. Incorporators: A. M. Hayes, J. W. Crowley, S. Moore and others, all of Kansas City.

AUSTIN, TEX.—Preston Bend Telephone Company, of Grayson County. $5,000. Incorporators: A. G. Noble, J. H. Willis, R. A. Owen and J. T. Watkins.

TRENTON, N. J.—New Jersey & Pennsylvania Power and Electric Company. $100,000. Incorporators: Howard Mutchler, C. L. Hemingway and R. A. Montgomery.

PHILADELPHIA, PA.—A dividend has been declared by the directors of the Philadelphia Traction Company of $2 per share, payable on April 1 to stock of record March 9.

ALLENTOWN, PA.—Philadelphia, Trenton & Lehigh Valley Railroad Company. $700,000. Directors: A. L. Johnson, C. M. Bates, H. C. Barrow, J. E. Kenney and W. J. Hartzell.

ALBANY, N. Y.—Queen City Telephone Company, of Buffalo. $500,000. Directors: Hardin H. Littell, Robert R. Hefford, Frank H. Goodyear, C. W. Goodyear, R. F. Schelling, E. A. George, of Buffalo, and S. E. Wayland, of Scranton, Pa.

TRENTON, N. J.—The Lancaster County Railway and Lake Company. $2,000,000. Incorporators: S. R. Shipley, of Philadelphia; W. W. Griest, of Lancaster; W. B. Given, of Columbia; P. B. Shaw, of Williamsport, and L. M. Garrison, of Jersey City.

ALBANY, N. Y.—The Richmond Beach Railway Company, of Staten Island. $20,000. Directors: Wm. B. Rockwell, John Eliot Bowles, M. J. Wightman, Harry T. Bowles, Russell S. Foot and Frank Coenen, of New York city; Everett L. Brown, of Perth Amboy, N. J.; M. P. Adelfinger, Brooklyn, and Charles Johnson, of Seaside, S. I.

LANSING, MICH.—Governor Bliss is said recently to have signed a bill amending the corporation law to permit the consolidation of the local electric light, street railway and gas companies, immediately afterward granting a charter for the consolidation of the Muskegon street railway, electric light and gas companies with a capital stock of $600,000.

Illinois Electric Vehicle Transportation Company.

A circular has been issued by the Illinois Electric Vehicle Transportation Company, which has just abandoned its public electromobile service in Chicago, announcing that it has been decided to liquidate the company. The assets will be disposed of and the proceeds distributed among the stockholders. The expenditures up to February 1 aggregated $724,348. The gross income to February 1 was $137,106 and total operating expenses $265,885, showing a loss of $128,778, with additional loss in depreciation of vehicles and station equipments. The company on the date mentioned had $205,458 in cash and owned 109 vehicles. The consent of the Electric Vehicle Company has been obtained to a cancellation of the contract between the two companies.

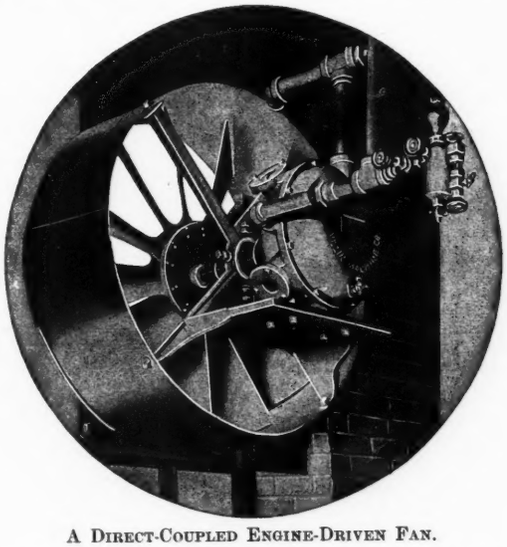
General Electric Dividend.

The directors of the General Electric Company on March 11, declared a regular quarterly dividend of $2 per share, payable April 15 to stock of record March 30.

A Direct-Coupled Engine-Driven Fan.

The accompanying illustration represents a 36-inch disk ventilating fan made by the American Blower Company, direct-coupled with one of their high-speed enclosed four-cylinder engines made by the Vezin Machine Company, of New York. It will be remembered that this engine was described in detail in the ELECTRICAL REVIEW for November 14, 1900.

Four cylinders are set 90 degrees apart in a solid frame, each cylinder being single-acting. The pistons are connected rigidly together in pairs, each pair working a rectangular frame in which the crank-pin brasses travel. All the valves are worked by a single cam. Lubrication is accomplished entirely by cylinder oil which is admitted with the steam supply, the exhaust passing out into the enclosed case in which are the pistons and crank. The engine runs at a speed of from 600 to 650 revolutions per minute, and its operation is said to be very smooth and satisfactory.



A DIRECT-COUPLED ENGINE-DRIVEN FAN.

Incendiary Electrical Fires in Chicago.

A newspaper despatch from Chicago, under date of March 10, says that according to the city electrical department, certain merchants and property owners who find an occasional fire "convenient" for business reasons, are making use of electric wires to produce the desired blaze. It is stated that 78 fires are known to have been caused in Chicago during the past year by electric wires, and while no figures are given as to the alleged incendiarism, it is stated that many of the fires were not due to accident. An ordinance to prevent careless or improper wiring has been framed, and will be urged for passage by the city council.

Postal Telegraph and Cable Company's Annual Meeting.

The annual meeting of the Postal Telegraph and Cable Company was held in New York on February 26, business of importance being transacted. All the old directors were reelected, and Mr. George Clapperton, the Commercial Cable Company's New York traffic manager, was also made a member of the board. The gentlemen reelected were: Sir William C. Van Horne, Jno. W. Mackay, E. C. Bradley, E. C. Platt, J. W. Ellsworth, Geo. C. Ward, C. R. Hosmer, W. H. Baker, C. H. Mackay, Albert B. Chandler. Mr. Clapperton was put in to fill the vacancy caused by the death of George S. Coe. The by-laws were amended to provide for the office of chairman of the board of directors, and Mr. Chandler, who has been the company's only president, was elected to fill the position. The other officers are: President, John W. Mackay; William H. Baker, vice-president and general manager; Edgar C. Bradley, George G. Ward, Clarence H. Mackay, vice-presidents; Edward C. Platt, treasurer; Theodore L. Cuyler, Jr., assistant treasurer; John O. Stevens, secretary; Charles P. Bruch, assistant secretary and assistant general manager. All these gentlemen were reelected, excepting Mr. Mackay, who took Mr. Chandler's place as head of the company.

Government Wireless Telegraphy.

Secretary Wilson of the department of agriculture is reported to have notified the navy department that his experts assert positively that they have evolved a system of wireless telegraphy radically different from Marconi's and of far greater efficiency.

United Electrical Contractors' Association of New York State.

Mr. W. H. Morton, 31 Catherine street, Utica, N. Y., secretary of the United Electrical Contractors' Association of New York State, requests the ELECTRICAL REVIEW to give further publicity to the following communication which has been sent to the principal contractors throughout the country:

In August, 1899, a number of electrical contractors of New York state held a meeting in Buffalo, and an organization known as the United Electrical Contractors' Association of New York state was formed, the purpose of this organization being for the protection of the mutual interest of the members and promoting a more cordial feeling in the contracting trade. This association takes in the larger contractors in all the cities of the state, and has proved itself a great benefit to all the members.

In view of the success of this organization, it was decided at our annual meeting held in January of this year, to issue a call for a meeting at the Builders' Exchange Building in Buffalo, N. Y., on Wednesday, July 17, 1901, at 10 A. M., for the purpose of forming a National Electrical Contractors' Association.

We feel very strongly that such an association will be a great benefit to the electrical contracting trade in many ways, and that the cost to each member for maintaining such an organization would be very small.

We have called this meeting in Buffalo, thinking that many of the contractors will arrange to attend the Pan-American Exposition, and consequently will be able to attend this meeting without additional expense.

If there is any electrical contractors' association in your city or state, we would be greatly obliged if you will furnish us with the names of the officers of such organization.

We would also be very glad to hear from you in regard to your views of the advisability of forming a National Electrical Contractors' Association, and to have you bring the matter up to the other contractors in your vicinity.

You will appreciate that there is a good deal of work in connection with forming an organization of this kind, and consequently we hope that you will let us hear from you promptly in regard to the matter, and that you will decide to be represented at the meeting in July.

Olds Motor Works Burned Out.

The plant of the Olds Motor Works, manufacturers of gas engines, automobiles and other vehicles, located on Jefferson avenue in Detroit, was completely destroyed by fire on March 9, entailing a loss of over $100,000. The plant was closed down at noon for half a day, and the fire broke out soon afterwards. It is supposed to have been caused by the explosion of two tanks of gasolene which were located in the building. In less than an hour the structure was practically destroyed. Two men at work on the third floor of the building were compelled to jump for their lives; one sustained a broken arm, and the other escaped uninjured. The entire season's output of the company's manufactured product, which was stored in the building, was destroyed. The plant was insured for $65,000.

Industrial Notes

J. JONES & SON, 64 Cortlandt street, New York, electrical supply dealers, announce that they will be able to furnish for early Spring deliveries the 1901 models of their electric fans.

THE REUTERDAHL ELECTRIC COMPANY, Providence, R. I., is manufacturing the "Reuterdahl" accumulators, which it claims to be durable, convenient and compact in shape and of large capacity.

THE BERGGREN HALF SHADE, for which the Electric Appliance Company, Chicago, is selling agent, is a device whereby the shade is attached direct to the socket, thus doing away with the necessity of a shadeholder.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has recently mailed its calendar blotter for March. This blotter is gotten up in blue and white, and under the calendar is a lamb on wheels, while on the right is a lion evidently suffering from extreme hunger.

THE DUMONT TOOL COMPANY, Buffalo, N. Y., is designing a new corner brace for electrical wiring work. The device is made in two sizes, one with 8-inch sweep, measuring 22 by 12 by 6 inches, while the other, with 10-inch sweep, measures 23 by 13 by 6 inches.

THE WARREN ELECTRIC AND SPECIALTY COMPANY, Warren, Ohio, manufacturer of the "Peerless" incandescent lamps, direct-current desk and ceiling fans and transformers, announces a new type of "Peerless" lamp, in a revised price list recently issued.

THE SPRAGUE ELECTRIC COMPANY, 527-531 West Thirty-fourth street, New York, has issued its catalogue No. 404 on "Interior Conduits." The book is handsomely gotten up, showing to advantage the many sorts of conduits made by the company. It will be mailed on request.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., is prepared to furnish arc light carbons for direct and alternating-current lamps. Specifications will receive prompt attention and the company advises that all requests for information will be cheerfully and promptly attended to.

MOLONEY TRANSFORMERS, built by the Moloney Electric Company, of St. Louis, Mo., are now giving results of the highest class in both electric lighting and power-transmission work. These transformers are built for any voltage or frequency and in any capacity desired, and embody a number of novel mechanical and electrical features.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has issued a neat 16-page bulletin of its different types of fans and fan motors for ventilating purposes, entitled "How Shall I Spend the Summer?" The little book contains 10 illustrations and copious descriptive matter. It will be mailed to any one interested upon application.

THE DIEHL MANUFACTURING COMPANY, Elizabethport, N. J., has recently placed on the market the 1901 type of its well-known fan. These fans are manufactured in several different styles, ceiling electrolier fans, column fans, counter-column fans, desk fans and bracket fans. It is also manufacturing special motors that are adaptable for other uses than turning fans.

THE AMERICAN ELECTRIC FUSE COMPANY, New York and Chicago, is mailing a neat booklet in red, telling of what the company is doing in the supply line. The pamphlet is captioned "*Hints By Fuse*," and describes at considerable length the specialties for which the company is celebrated. It will be mailed to any one desiring it, with any other information asked for, upon application to the company at either office.

THE DE DION-BOUTON MOTORETTE COMPANY, Church lane and Thirty-seventh street, Brooklyn, N. Y., announces that the demand for its vehicles has been so large with the commencement of its Spring trade that it has been almost impossible to fill the orders, although increased facilities have enabled its factory to handle a larger amount of business than ever before. Owing to this demand the company is considering the further enlargement of its factory.

LOWE & LEVERIDGE, 183 Greenwich street, New York, electrical supply dealers, are marketing two new specialties, the L. & L. ceiling switch, and the L. & L. showcase lighting fixture. The ceiling switch is operated by a pendant and is made for 15 amperes at 250 volts. It has received the approval of the National Board of Fire Underwriters. The showcase lighting fixture is designed for attachment at the top of the showcase inside, and throws the light downward.

SEVERAL IMPROVEMENTS have been made in the Samson battery, manufactured by the Electric Gas Lighting Company, 195 Devonshire street, Boston, Mass., which is so arranged that the elements can not come in contact with the inside of the jar which has been fitted with rubber rings and plugs and placed outside the binding-posts of the carbon. Charges of depolarizing compound are furnished by which the battery can easily be recharged. The company states that these batteries are made of specially prepared materials and each part particularly adapted for the use to which it is put.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., calls attention in a good-sized pamphlet to the Students' Aid Department, whose object is to assist students taking the courses offered by the schools when they prove themselves earnest and capable in their desire to learn. Testimonials from both students and employers are shown on opposite pages, and the facts, as stated in the pamphlet, seem to indicate that the work the schools are doing is all that the Colliery Engineer Company claims for it.

THE ECONOMY ELECTRIC COMPANY, Warren, Ohio, makes the two following propositions to users of incandescent lamps: First: it agrees to pay cash for burned-out incandescent lamps, and wishes to be advised as to how many and what kind are offered, when a proposition will be returned. Second: it agrees to furnish "Economy" incandescent lamps, guaranteed to be equal to any on the market, at 13 cents each for 6 to 20 candle-power—19 cents for 32 candle-power—and agrees to give three cents each for an equal (not a greater) number of burned-out lamps. It prepays freight on its shipments and expects the second party to prepay freight on its shipments.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, reports the following installations for the month of February, and in addition to this list it has been subjected to a heavier call than usual for machines of the smaller types: one 75-kilowatt, direct-connected generator, for the town of Versailles, Ohio; a 50-kilowatt, direct-connected generator for the plant at Perham, Minn.; one 125-kilowatt, belted generator, together with several small motors, for the Jamestown Electric Light Company, Jamestown, N. D.; a 100-kilowatt, belted generator for the plant at Devil's Lake, N. D., and a large direct-connected generator for the new hotel at Sioux City, Iowa.

THE MONARCH FIRE APPLIANCE COMPANY, 27 William street, New York, is mailing a list of the electrical companies using its fire extinguisher, "Kilfyre." Prominent among the companies named are the Edison Illuminating Company of New York City (all stations), United Traction Company, Pittsburgh, Pa., the Chicago and Cleveland telephone companies, the Michigan Telephone Company (all exchanges), American District Telegraph Company, Postal Telegraph and Cable Company, Western Union Telegraph Company, and the Newark District Telegraph Company, Newark, N. J. Descriptive matter and catalogues will be sent to any one interested on receipt of stamp.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., manufacturer of the "Chloride Accumulators," has found it necessary to open a sales office in San Francisco, Cal., to take care of the increasing volume of business in the far west and along the Pacific coast. Mr. R. B. Daggett has been placed in charge of this office, leaving the staff of engineers in Philadelphia for that purpose. This company has recently closed a contract with the United Electric Light and Power Company, of Baltimore, for the installation of a battery of "Chloride Accumulators" consisting of 132 elements, having a capacity of 1,200 ampere hours and with tanks permitting an increase by additional plates to a capacity of 2,100 ampere hours. The battery will be located 5,000 feet from the power-house and will be operated in connection with two boosters having a capacity of 500 amperes at 35 volts.

THE UNITED STATES MINERAL WOOL COMPANY, 143 Liberty street, New York, states that its product is one of the most successful means in use for insulating the rooms and halls of large buildings from heat and cold. Another point claimed for the wool is that when it is used in wall construction it very materially deadens sound and greatly increases the convenience of the residents in large buildings where different operations and businesses are being conducted, some of them noisily and some of them quietly. This company's asbestos sheathing is said to be absolutely fireproof and has the same sound-deadening effect as the wool, making it desirable from both standpoints. It is stated that its fusing point is 2,200 degrees Fahrenheit. This proves it to be fireproof to ordinary degrees of heat. Catalogues and full information will be mailed to any one interested on application to the company.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, advises that it has booked the following orders for home and export shipment: Glasgow *Evening News*, Glasgow, Scotland, three motor generators; London *Daily Express*, London, England, three motor generators; Montreal Water and Power Company, Montreal, Canada, one 400-horse-power, three-phase motor; Aberdeen *Journal*, Aberdeen, Scotland, one 30-horse-power, teaser equipment, and one motor generator; Carnegie Steel Company, Pittsburgh, Pa., one 25-horse-power, type "H" motor; Greuner & Company, Johnstown, Pa., one 30-kilowatt, type "I" generator; Brown & Sharpe, Providence, R. I., four type "N" motors for direct connection to machine tools; Wier Frog Company, Cincinnati, Ohio, three 10-horse-power, type "N" motors; Pullman Company, Pullman, Ill., two 150-kilowatt, type "H" generators; Mosler Safe Company, Hamilton, Ohio, one 50-horse-power, type "H" motor; Susquehanna Valley Electric Company, Sidney, N. Y., one 65-kilowatt, single-phase generator; Central Lard Company, New York city, N. Y., one 65-kilowatt, engine type generator; Buffalo *Evening News*, Buffalo, N. Y., one 70-horse-power, type "H" motor.